



BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

**ADVISORY COUNCIL REGULAR MEETING:  
JOINT MEETING OF THE AIR QUALITY PLANNING  
COMMITTEE AND TECHNICAL COMMITTEE**

**AGENDA**

**TECHNICAL COMMITTEE:**

LOUISE BEDSWORTH, PH.D., CHAIRPERSON  
SAM ALTSHULER, P.E.  
ROBERT BORNSTEIN, PH.D.  
STAN HAYES  
NORMAN A. LAPERA, JR.  
WILLIAM HANNA  
JOHN HOLTZCLAW, PH.D.

**AIR QUALITY PLANNING COMMITTEE:**

HAROLD BRAZIL, CHAIRPERSON  
DIANE BAILEY  
EMILY DRENNEN  
IRVIN DAWID  
FRED GLUECK  
KRAIG KURUCZ  
JOHN HOLTZCLAW, PH.D.  
KEVIN SHANAHAN

TUESDAY  
APRIL 6, 2004

BOARD ROOM  
9:30 A.M.

1. **Call to Order – Roll Call**
2. **Public Comment Period**

*Public Comment on Non-Agenda Items, Pursuant to Government Code Section 54954.3. The public has the opportunity to speak on any agenda item. All agendas for Committee meetings are posted at the District, 939 Ellis Street, San Francisco, at least 72 hours before a meeting. At the beginning of the meeting, an opportunity is also provided for the public to speak on any subject within the Committee's purview. Speakers are limited to five minutes each.*

3. **Approval of Minutes:**

A) **Air Quality Planning Committee – February 3, 2004**  
B) **Technical Committee – February 24, 2004**

4. **2004 Ozone Strategy – Preliminary Control Measure Descriptions**

*District staff will provide a presentation on draft stationary and mobile Source control measures, and draft transportation control measures.*

**5. Committee Member Comments/Other Business**

*Committee members, or staff, on their own initiative, or in response to questions posed by the public, may ask a question for clarification, make a brief announcement or report on his or her own activities, provide a reference to staff regarding factual information, request staff to report back at a subsequent meeting on any matter or take action to direct staff to place a matter of business on a future agenda*

**6. Time and Place of Next Meeting**

*Air Quality Planning Committee: 9:30 a.m., Tuesday, June 1, 2003  
Technical Committee: 9:30 a.m., Thursday, June 3, 2004.  
939 Ellis Street, San Francisco, CA 94109.*

**7. Adjournment**

**CONTACT CLERK OF THE BOARDS - 939 ELLIS STREET SF, CA 94109**

**(415) 749-4965**  
**FAX: (415) 928-8560**  
**BAAQMD homepage:**  
**[www.baaqmd.gov](http://www.baaqmd.gov)**

- To submit written comments on an agenda item in advance of the meeting.
- To request, in advance of the meeting, to be placed on the list to testify on an agenda item.
- To request special accommodations for those persons with disabilities notification to the Clerk's Office should be given in a timely manner, so that arrangements can be made accordingly.

LB/HB;jc

**BAY AREA AIR QUALITY MANAGEMENT DISTRICT**  
**939 ELLIS STREET, SAN FRANCISCO, CALIFORNIA 94109**  
**(415) 771-6000**

**CLERK OF THE BOARDS OFFICE:**  
**MONTHLY CALENDAR OF DISTRICT MEETINGS**

**MARCH 2004**

<b><u>TYPE OF MEETING</u></b>	<b><u>DAY</u></b>	<b><u>DATE</u></b>	<b><u>TIME</u></b>	<b><u>ROOM</u></b>
<b>Board of Directors Executive Committee</b> <i>(Meets 5<sup>th</sup> Wednesday of Months that have 5 Wednesdays)</i>	Monday	29	9:30 a.m.	4 <sup>th</sup> Floor Conf. Room

**APRIL 2004**

<b><u>TYPE OF MEETING</u></b>	<b><u>DAY</u></b>	<b><u>DATE</u></b>	<b><u>TIME</u></b>	<b><u>ROOM</u></b>
<b>Advisory Council Joint Air Quality Planning &amp; Technical Committees</b>	Tuesday	6	9:30 a.m.	Board Room
<b>Board of Directors Regular Meeting</b> <i>(Meets 1<sup>st</sup> &amp; 3<sup>rd</sup> Wednesdays each Month)</i>	Wednesday	7	9:45 a.m.	Board Room
<b>Board of Directors Mobile Source Committee</b> <i>(Meets 2<sup>nd</sup> Thursday each Month)</i>	Thursday	8	9:30 a.m.	4 <sup>th</sup> Floor Conf. Room
<b>Board of Directors Public Outreach Committee</b> <i>(Meets 2<sup>nd</sup> Monday every other Month)</i>	Monday	12	9:45 a.m.	4 <sup>th</sup> Floor Conf. Room
<b>Board of Directors Personnel Committee</b>	Wednesday	14	9:30 a.m.	4 <sup>th</sup> Floor Conf. Room
<b>Advisory Council Public Health Committee</b>	Monday	19	1:30 p.m.	Board Room
<b>Board of Directors Regular Meeting</b> <i>(Meets 1<sup>st</sup> &amp; 3<sup>rd</sup> Wednesday each Month)</i>	Wednesday	21	9:45 a.m.	Board Room
<b>Board of Directors Budget &amp; Finance Committee</b> <i>(Meets 4<sup>th</sup> Wednesday each Month)</i>	Wednesday	28	9:45 a.m.	4 <sup>th</sup> Floor Conf. Room

**MAY 2004**

<b><u>TYPE OF MEETING</u></b>	<b><u>DAY</u></b>	<b><u>DATE</u></b>	<b><u>TIME</u></b>	<b><u>ROOM</u></b>
<b>Board of Directors Regular Meeting</b> <i>(Meets 1<sup>st</sup> &amp; 3<sup>rd</sup> Wednesdays each Month)</i>	Wednesday	5	9:45 a.m.	Board Room
<b>Advisory Council Executive Committee</b>	Wednesday	12	9:00 a.m.	Room 716
<b>Advisory Council Regular Meeting</b>	Wednesday	12	10:00 a.m.	Board Room
<b>Advisory Council Public Health Committee</b>	Monday	12	12:30 p.m.	Room 716

<b>Board of Directors Mobile Source Committee</b> <i>(Meets 2<sup>nd</sup> Thursday each Month)</i>	<b>Thursday</b>	<b>13</b>	<b>9:30 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Regular Meeting</b> <i>(Meets 1<sup>st</sup> &amp; 3<sup>rd</sup> Wednesdays each Month)</i>	<b>Wednesday</b>	<b>19</b>	<b>9:45 a.m.</b>	<b>Board Room</b>
<b>Board of Directors Stationary Source Committee</b>	<b>Monday</b>	<b>24</b>	<b>9:30 a.m.</b>	<b>Board Room</b>
<b>Board of Directors Budget &amp; Finance Committee</b> <i>(Meets 4<sup>th</sup> Wednesday each Month)</i>	<b>Wednesday</b>	<b>26</b>	<b>9:45 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>

## **J U N E    2 0 0 4**

<u><b>TYPE OF MEETING</b></u>	<u><b>DAY</b></u>	<u><b>DATE</b></u>	<u><b>TIME</b></u>	<u><b>ROOM</b></u>
<b>Advisory Council Air Quality Planning Committee</b>	<b>Tuesday</b>	<b>1</b>	<b>9:30 a.m.</b>	<b>Room 716</b>
<b>Board of Directors Regular Meeting</b> <i>(Meets 1<sup>st</sup> &amp; 3<sup>rd</sup> Wednesdays each Month)</i>	<b>Wednesday</b>	<b>2</b>	<b>9:45 a.m.</b>	<b>Board Room</b>
<b>Advisory Council Technical Committee</b>	<b>Thursday</b>	<b>3</b>	<b>9:30 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Mobile Source Committee</b> <i>(Meets 2<sup>nd</sup> Thursday each Month)</i>	<b>Thursday</b>	<b>10</b>	<b>9:30 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Public Outreach Committee</b>	<b>Monday</b>	<b>14</b>	<b>9:45 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Regular Meeting</b> <i>(Meets 1<sup>st</sup> &amp; 3<sup>rd</sup> Wednesdays each Month)</i>	<b>Wednesday</b>	<b>16</b>	<b>9:45 a.m.</b>	<b>Board Room</b>
<b>Board of Directors Budget &amp; Finance Committee</b> <i>(Meets 4<sup>th</sup> Wednesday each Month)</i>	<b>Wednesday</b>	<b>23</b>	<b>9:45 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>
<b>Board of Directors Executive Committee</b> <i>(Meets 5<sup>th</sup> Wednesday of Months that have 5 Wednesdays)</i>	<b>Wednesday</b>	<b>30</b>	<b>9:45 a.m.</b>	<b>4<sup>th</sup> Floor Conf. Room</b>

MR:hl  
3/24/04 (8:00 a.m.)  
P/Library/Calendar/Moncal

**AGENDA NO. 3a**

Bay Area Air Quality Management District  
939 Ellis Street  
San Francisco, California 94109

**DRAFT MINUTES**

Advisory Council  
Air Quality Planning Committee Meeting  
9:00 a.m., Tuesday, February 3, 2004

- 1. Call to Order – Roll Call.** 9:40 a.m. Quorum Present: Harold Brazil, Chairperson, Emily Drennen, Irvin Dawid, Fred Glueck, John Holtzclaw, Ph.D., Kraig Kurucz, Kevin Shanahan. Absent: Pamela Chang.
- 2. Public Comment Period.** There were none.
- 3. Approval of Minutes of July 22 and September 30, 2003.** Dr. Holtzclaw requested that “Bittle” be corrected to “Brittle” in line one of paragraph two on page four of the September 30, 2003 minutes. Mr. Glueck moved approval of the September 30, 2003 minutes as amended, as well as the approval of the July 22, 2004 minutes; seconded by Mr. Shanahan; carried unanimously.
- 4. Control Measure Review.** Dan Belik, Rule Development Section Manager, stated he would review pollution control measure criteria, the legal background concerning them, the control measure suggestions received to date by the District, and the control measures in the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) and the South Coast Air Quality Management District (SCAQMD) that are being evaluated for possible inclusion in the forthcoming update to the District’s Ozone Attainment Plan.

The District’s evaluation criteria for pollution control measures include the type of pollutant controlled, amount and rate of emission reduction, technical feasibility, public acceptability, enforceability, cost effectiveness, socioeconomic impacts, environmental impacts, and determines whether or not the reductions are eligible for credit in the State Implementation Plan (SIP) process by being real, quantifiable, permanent, enforceable and surplus.

The California Clean Air Act (CCAA) requires the District either to achieve a 5% reduction in ozone precursors annually or implement “all feasible measures.” Guidance for defining the latter is derived from “Best Available Retrofit Control Technology” (BARCT) as well as the categories in the CCAA that refer to relative cost-effectiveness, technological feasibility, total pollution reduction potential, rate of reduction, public acceptability and enforceability. The District defines “feasible” as reasonable and necessary; capable of being successfully implemented within a reasonable time period, taking into account economic, environmental, legal, technological and social factors; and either approved or approvable by the California Air Resources Board (CARB).

The federal planning process is less stringent in the consideration of control measures. It requires measures based on all Reasonably Available Control Technology (RACT) but only within the context of local environmental circumstances rather than in consideration of advancing an attainment date. Pollutant transport between States is also a consideration in the federal process.

The District has evaluated 370 pollution control measures. Many were suggested by the Ozone Working Group, community members, the Advisory Council, Board of Directors and CARB, as well as a review of the rules and plans of other air districts in the state. In its preliminary findings, staff has categorized these measures as follows:

- 5 - not enforceable
- 6 - not technically feasible
- 9 - need legislation
- 14 - not cost-effective
- 17 - pose pollutant transport problems
- 29 - require further study
- 29 - require funding
- 31 - potentially viable
- 53 - already implemented
- 82 - offer only negligible emission reductions
- 95 - under the regulatory jurisdiction of other agencies

The District has already adopted many of the control measures that are under consideration in the SJVUAPCD. The SCAQMD is working to develop control strategies that are under the jurisdiction of CARB. Of the potentially viable measures, preliminary findings identify as most promising the SCAQMD measure on miscellaneous industrial coatings and solvent operations. This measure concerns facilities that annually emit greater than 25 tons of volatile organic compound (VOCs) emissions. Similarly, the SJVAPCD measure on sumps, pits and wastewater processing equipment was contained in the District's 2001 Ozone Attainment Plan as a further study measure. This will be the subject of a future Technical Assessment Document. Four potential measures in the SJVAPCD that mitigate nitrogen oxide (NO<sub>x</sub>) transport include agricultural irrigation engines, stationary gas turbines, water heaters and boilers, and steam generators, boilers and process heaters. Modeling will assess the downwind impacts of NO<sub>x</sub> reductions from these sources.

Measures requiring further study include (a) an SCAQMD NO<sub>x</sub> mitigation fee program for planes, trains and ships, the funds from which would be used to reduce emissions elsewhere; (b) an SJVAPCD indirect source mitigation program addressing traffic emission increases resulting from large developments; and (c) stationary source controls in both of these air districts on stationary internal combustion engines, livestock waste, glass melting furnaces, architectural coatings and solvents, commercial and industrial composting and commercial char broilers.

Measures requiring legislative authorization in the SCAQMD relate to off-road vehicles and equipment, an emission fee program for port-related mobile sources, and an emission fee program of \$5,000 per ton of VOC for facilities that emit more than 10 tons annually. In the SJVAPCD, such authorization would be needed for a federally mandated ozone non-attainment fee program.

Measures in the SCAQMD and SJVAPCD that are not technically feasible include further emission reductions from large VOC sources and industrial process operations which would be based on far-reaching emission reduction plans that have not yet been demonstrated to be feasible. The District could consider these as further study measures but cannot incorporate them into an attainment plan.

The District has concluded that some measures are not cost-effective, such as the SJVAPCD measures on boilers, steam generators and process heaters, as well as wineries, and the SCAQMD measure on further emission reductions from restaurant operations.

Control measures in the SCAQMD with either negligible emission reductions or which lack emission sources in the Bay Area include truck stop electrification, urban heat island mitigation and further NO<sub>x</sub> reductions from the RECLAIM emissions trading project. Controls on chamber fumigation of agricultural products in the SJVAPCD have no counterparts in the Bay Area.

There are more steam driven oil production wells in the SJVAPCD than in the BAAQMD, and proposed controls in the SJVAPCD on low-pressure flares are not applicable to Bay Area refinery flare controls. There is only one lime kiln in the SJVAPCD and none in the Bay Area. The District has already adopted and implemented a rule for polymeric foam manufacturing, the stringency of which cannot be increased in the Bay Area. The SJVUAPC is considering a similar rule.

Many of the other measures proposed in the SCAQMD are under the regulatory jurisdiction of other agencies—in particular, CARB—and concern engine exhaust, off-road construction, weed trimmers, lawnmowers, and vehicle Inspection and Maintenance (I&M). The proposed control of fuel transfer into aircraft is pre-empted by Federal Aviation Administration regulations. Ground support equipment at airports, low sulfur diesel fuel standards, and land-based emissions at ports are under consideration by the SCAQMD but are under the regulatory jurisdiction of CARB.

In discussion, Mr. Glueck suggested staff consider a measure to reduce government employee work trips through improved transit and telecommuting options. Mr. Belik responded that mobile source emissions account for half of the total emission inventory and are becoming cleaner over time. The effort to reduce the percentage of government employees work trips would be the subject of a transportation control measure (TCM) adopted by the Metropolitan Transportation Commission (MTC), which is holding public workshops and community meetings to promote education regarding the use of carpools, trip linking and taking public transit.

Chairperson Brazil added that TCMs must conform to specific criteria to be eligible for inclusion in the Regional Transportation Plan. Work trips in excess of the number of government employee work trips would have to be reduced to significantly impact mobile source emissions. Changing land-use patterns to make transit usage more convenient provides an ideal approach to reducing vehicle usage, notwithstanding that the Bay Area as a region is already fairly well built-out.

Ms. Drennen inquired as to whether the District's cost-effectiveness criteria for pedestrian and bike facilities may impede project implementation with only marginal air pollution improvements. Jean Roggenkamp, Planning Division Director, responded that the Transportation Fund for Clean Air (TFCA) has assisted in funding bicycle facilities that are associated with commute services, with cost-effectiveness criteria focused on an incentive, rather than regulatory basis. The cost-effectiveness criterion for TFCA projects is \$90,000 per ton of emissions reduced.

Mr. Brazil inquired if District funding criteria posed obstacles to increasing the number of bicycle lockers at BART stations. Mr. Dawid noted that he recently participated in a mobile tour of bike facilities at BART stations and found major differences between them in terms of security, proximity to the station, etc. Mr. Hess responded that staff would investigate this issue.

Mr. Shanahan observed that more progress would be made by the State's air districts in reducing pollution if CARB were to adopt more stringent rules. Mr. Hess replied that CARB recently held an ozone control summit meeting with the State's air districts on pollution control measures and emission reductions. Further emission reductions from heavy-duty trucks and off-road sources could be obtained from additional regulations. Mobile source emissions can be further reduced. The District, the SCAQMD and SJVAPCD each have a seat on the CARB Board of Directors.

Gary Kendall, Technical Division Director, stated that 10% of the vehicle fleet is estimated to emit more than 50% of total vehicle emissions. This poses challenges for both vehicle I&M and scrappage programs. Over the long-term the fleet is going to become cleaner. Mr. Kurucz noted that last year this Committee made several recommendations to improve vehicle I&M and scrappage programs and later this year will receive an update on their implementation. One issue concerns how the Enhanced I&M program in the Bay Area is receiving emission reduction credits. Mr. Hess replied that CARB has added the emission reductions from the Enhanced I&M program into its Emission Factor Model (EMFAC) and it now receives federal emission reduction credit.

Ms. Drennen inquired as to how vehicle I&M and scrappage programs take low-income groups into account, and whether the District facilitates the encouragement of mode shift among low income groups in the Bay Area. Ms. Roggenkamp replied that the Bureau of Automotive Repair (BAR) sponsored a subsidy program geared toward low-income owners whose cars failed the emissions test, but the funds for that program have been cut. The District sponsors a vehicle scrappage program and surveys the program participants. The results suggest that significant emission reductions are achieved. Mr. Kurucz added that last year this Committee found that the number of Bay Area vehicle owners that received a repair waiver was approximately 200. The Committee requested the Deputy Clerk to provide copies of its minutes and reports on I&M.

Mr. Dawid inquired as to the relationship of vehicle speed to air quality. Chairperson Brazil replied that he could refer him to one of the consultants who contracts with MTC to perform this type of analysis. Mr. Dawid and Dr. Holtzclaw added that reducing a three-lane road to two lanes with a turning median tends to increase road capacity to carry cars and reduces vehicular crashes. Mr. Glueck noted that it is not only vehicle age that effects its emission levels but also its mileage. Mr. Kurucz suggested that staff develop emission estimates per category of vehicle. Mr. Shanahan requested that the staff report also compare advanced diesel fuel sports utility vehicles with gasoline powered ones by fuel economy. Mr. Hess noted that such data would prove useful for the analysis of mobile source emissions of ozone precursors and greenhouse gases.

Dr. Holtzclaw suggested that extra credit be given in the SIP for Smart Growth measures because these will reduce pollution over time. Urban heat island strategies relate symbiotically to improved livability and Smart Growth. Mr. Belik responded that quality of life improvements and socio-economic impacts concern public acceptability and the rephrasing of evaluation criteria more than emission reduction credits. From a federal perspective, emission reductions must be enforceable to receive credit, and under the State program all feasible measures must be implemented. Urban heat island measures are most effective in regions with consistently high temperatures.

Mr. Hess added that Advisory Council member Lapera is overseeing the removal of eucalyptus trees in the East Bay. These trees are high emitters of ozone precursors. The District has written to Bay Area cities and counties and requested that they plant trees that emit low levels of ozone precursors.



Mr. Kurucz inquired if further VOC emission reductions were possible, based on the SCAQMD architectural coatings rule, and further, if District the is considering control measures on consumer products. Mr. Belik replied that the SCAQMD architectural coatings rule has been amended twice, and the challenge is whether coatings with further VOC reductions could be successfully applied to all intended applications. CARB has surveyed the coatings rules in California and has obtained product reactivity data from coating manufacturers. CARB also regulates consumer products and has scheduled a round of emission reductions in 2006 followed by another in 2008-2010. No such measures are presently found in the attainment plans of the SCAQMD or SJVAPCD.

Mr. Kurucz inquired if the SCAQMD rule on small water heaters applies to residences. Mr. Belik responded that the rule concerns small industrial water heaters. However, the manufacturers have been unable to meet the emission standard, and therefore they pay fees to the SCAQMD in lieu of attaining that standard. In addition, energy conservation standards also conflict with the emission limits proposed by the SCAQMD, and the manufacturers have recently addressed the SCAQMD Board of Directors with their concerns on this issue.

Mr. Kurucz inquired if the measures under consideration on composting operations are industrial or municipal. Mr. Belik stated that these relate to industrial composting operations that develop large amounts of compost for gardening and farm use. The rule addresses controlling rooms where the compost is stored. The District will review this rule as a further study measure.

Dr. Holtzclaw inquired as to the distinctions in the reactivity of various VOC compounds as it relates to the peak formation of ozone within or downwind from the District. Mr. Belik stated that Dr. William Carter of U.C. Riverside has developed extensive data on the reactivity of VOC compounds. Mr. Hess added that the Modeling Advisory Committee would address this issue in its evaluation of the photochemical modeling analysis that is part of the update to the ozone attainment plan.

Chairperson Brazil thanked District staff for its presentation and noted that the Committee appreciated the opportunity to discuss these control measure suggestions and provide input.

5. **Committee Member Comments/Other Business.** Ms. Drennen requested that staff make a presentation, at a future meeting, about what the District does regarding pedestrian and bike issues in the region, including what funding sources can be used or are already being used, which cannot be used, and what guidelines preclude the use of such funds. It would be useful to review how an exemption might be obtained for small ticket projects that improve air quality but do not meet the \$90,000 per ton cost-effectiveness criterion. Mr. Hess noted that this presentation would be available after the staff's work on the ozone attainment plan has been completed.
6. **Time and Place of Next Meeting.** 9:30 a.m., Tuesday, April 6, 2003, 939 Ellis Street, San Francisco, CA 94109.
7. **Adjournment.** 11:22 a.m.

James N. Corazza  
Deputy Clerk of the Boards

**AGENDA NO. 3b**

Bay Area Air Quality Management District  
939 Ellis Street  
San Francisco, California 94109

**DRAFT MINUTES**

Advisory Council Technical Committee  
9:30 a.m., Tuesday, February 24, 2004

1. **Call to Order – Roll Call.** 9:37 a.m. Quorum present: Louise Bedsworth, Ph.D., Chairperson, William Hanna, Stan Hayes, John Holtzclaw, Ph.D. Absent: Sam Altshuler, P.E., Robert Bornstein, Ph.D., Norman A. Lapera, Jr.
2. **Public Comment Period.** There were no public comments.
3. **Approval of Minutes of December 9, 2003.** Mr. Hanna moved approval of the minutes; seconded by Dr. Holtzclaw; carried unanimously.
4. **Control Measure Review.** Dan Belik, Rule Development Manager, stated the District is updating its Ozone Attainment Plan (OAP) and has received suggestions on control measures from the Ozone Working Group, California Air Resources Board (CARB), Advisory Council, Board of Directors, community members and downwind air districts. The plans and draft plans of other air districts have also been reviewed. The applicability to the Bay Area Air Quality Management District (BAAQMD) of control measures contained in the plans of the South Coast Air Quality Management District (SCAQMD) and San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) is the subject of today's presentation.

Federal evaluation criteria require an air district to adopt all reasonably available control measures in light of local circumstances, except if an attainment date is not advanced, adverse economic or environmental impacts would ensue, or only minor emission reductions would be achieved at a major administrative cost. For measures to be eligible to receive emission credit in the State Implementation Plan (SIP) they must be real, quantifiable, permanent, enforceable and surplus.

The California Clean Air Act (CCAA) requires an air district to achieve either a 5% reduction in ozone precursors annually or to adopt "all feasible measures." No region in California has been able to meet the 5% goal. Therefore, all feasible measures must be adopted. In defining feasibility, transport mitigation regulations and aspects of the state law provide some guidance in taking into account economic, environmental and energy factors, as well as the emission reduction rate.

The BAAQMD considers a control measure feasible if it is reasonable and necessary; capable of being successfully implemented in a reasonable time period, taking into account legal, economic, environmental, social and technological factors; and is approved or approvable by CARB. Evaluation criteria include the pollutant controlled (i.e., volatile organic compounds (VOC) or nitrogen oxide (NOx)), amount and rate of emission reduction, technical feasibility, public acceptability, enforceability, cost effectiveness, socioeconomic impacts, environmental impacts, and whether the reductions are real, quantifiable, permanent, enforceable and surplus.

Mr. Belik noted that the federal Environmental Protection Agency (US EPA) has not adopted rules or guidelines regarding reactivity among VOC compounds. Perhaps as the emission reductions decrease and costs per ton of emissions reduced increase, reactivity may play a greater role in rule feasibility assessment. With regard to the role reactivity plays in influencing ozone formation and transport downwind, Mr. Belik stated that greater weight is given to the total ozone produced rather than to specific rates of production. However, reaction rates have been measured against the one-hour ozone standard in reactivity studies, and this issue is under discussion in some scientific circles. Reactivity would have less impact under the eight-hour ozone standard.

Saffet Tanrikulu, Research & Modeling Manager, stated that while VOC species can be differentiated according to reactivity, the process that converts nitrogen oxide (NO<sub>x</sub>) to nitrogen dioxide (NO<sub>2</sub>) in the atmosphere takes approximately 20 minutes. Varying levels of VOC reactivity will therefore not likely affect pollution transport. Gary Kendall, Technical Division Director, added that the most modern models allow an emissions inventory, when compiled and disaggregated in space and time, to be queried according to VOC species reactivity profiles for a specific source category at a given point in time. Mr. Hayes noted that the consideration of the time at which a VOC emission would be reduced would be of importance in review of ozone formation.

Mr. Belik stated that staff has reviewed over 370 control measures in its update to the 2004 OAP, and has placed these measures into categories as follows:

- 5 – not enforceable
- 6 – not technically
- 9 – need legislation
- 14 – are not cost effective
- 17 – have potential transport mitigation
- 29 – require funding
- 29 – require further study
- 31 – potentially viable
- 53 – area already implemented in the District
- 82 – offer only negligible reductions
- 95 – are under other jurisdictions.

There are control measures in these plans for which the BAAQMD has no, or very few, sources, or which are already more stringently controlled by it. The BAAQMD has already implemented many of the measures proposed in the SJVUAPCD. It appears that the SCAQMD is adopting measures to force CARB to be more aggressive in adopting regulations. The SCAQMD rule on miscellaneous industrial coatings required add-on controls for the largest paint booths that emit more than 25 tons of VOCs. If applied on an operation-by-operation basis in the Bay Area, this approach may cost-effectively reduce emissions in the BAAQMD. The SJVUAPCD measure on sumps, pits and wastewater processing equipment may also entail notable VOC emission reductions if applied in the Bay Area. It would result in the installation at refineries of water traps in wastewater drain systems and seals after the oil-water separation phase to reduce emissions from wastewater treatment processes.

The potentially viable measures in the SJVUAPCD that, if adopted in the Bay Area, would reduce NO<sub>x</sub> transport include controls on agricultural irrigation engines, water heaters and boilers, stationary gas turbines, steam generators and process heaters.

Measures in the SCAQMD that would require further study by the BAAQMD include a federal source mitigation fee program, and an architectural coatings and solvents rule. Further study measures from the SJVUAPCD plan would include an indirect source mitigation program, a measure on NOx emissions from stationary internal combustion engines, glass melting furnaces, livestock waste, commercial and industrial composting and commercial char broilers.

SCAQMD control measures that require legislation include off-road vehicles and equipment, an emission fee program for port-related mobile sources, a program imposing a VOC emission fee of \$5,000 per ton for facilities emitting more than 10 tons per year and a federally mandated ozone non-attainment fee. In reply to Mr. Hayes, Ms. Roggenkamp stated that, for port-related mobile sources, the District will not adopt regulations to implement cold ironing but has recommended that the City of Oakland investigate this through the environmental review process. CARB is also reviewing cold ironing for possible application statewide. Mr. Belik added that the addition of a new port facility or cruise terminal provides an ideal opportunity to implement cold ironing, and it might be considered as a mitigation measure in the permit review process. Mr. Hanna observed that a federal mandate to require cold ironing at all ports in California would minimize adverse the impacts on commerce and industry that would occur if it were applied in a piecemeal manner.

Mr. Belik stated that measures in the SCAQMD plan that are considered by staff to be technically infeasible include further emission reductions from large VOC sources, industrial process operations and residential water heaters. There may be conflict between energy efficiency mandates and existing regulations regarding residential water in the SCAQMD.

Measures in the SCAQMD with negligible emission reductions or for which there are no comparable Bay Area sources include truck stop electrification, urban heat island mitigation, economic incentive programs and additional NOx reductions under the emissions trading RECLAIM project. Similar measures in the SJVUAPCD include asphalt batch plant dryer and heaters, bakery ovens, and can and coil coatings, natural gas fuel specifications, among other rules.

Many of the control measures considered by the SCAQMD are already under CARB jurisdiction. The SCAQMD also wants to improve vehicle Inspection & Maintenance (I&M) beyond its most stringent form. Ms. Roggenkamp added that CARB has recently reviewed areas with further emission reduction potential and is considering a pilot program to replace or upgrade the emission control systems on passenger vehicles. The District is interested in sponsoring such a program.

Chairperson Bedsworth and Mr. Hayes notes that the air quality dynamics in the SJVUAPCD and BAAQMD differ, and ozone control measures implemented in one region would have different impacts on the other. Mr. Belik added that there is a high VOC to NOx ratio in the SJVUAPCD. NOx measures would likely be more effective there than in the SCAQMD.

Chairperson Bedsworth noted that revenue generation for control measures and the need to reduce mobile source emission are key concerns. She inquired as to what authority the District has to generate revenue for emission reduction programs and the extent to which remote sensing of vehicle emissions and vehicle scrappage programs will figure into the update to the OAP. Ms. Roggenkamp replied that vehicle license registration fees at \$20 million fund the Transportation Fund for Clean Air (TFCA) annually. The District also received funds from the Carl Moyer Program for reducing heavy-duty engine emissions. The future of this program is uncertain, and the District recently received what may be the final installment of Moyer program funds.

Mr. Kendall noted that neither CARB nor the Bureau of Automotive Repair (BAR) is enamored of remote sensing technology in the evaluation of vehicular emissions. CARB has a greater interest in vehicle scrappage programs. Ms. Roggenkamp added that the District sponsors a scrappage program for vehicles manufactured prior to 1981. This program has worked well to date.

Mr. Belik stated that there are additional measures in the SCAQMD plan that are regulated by CARB, such as new hand-held and non-hand-held small engines, new off-road gas engines, enhanced vapor recovery at aboveground storage tanks, portable internal combustion engines, the recovery of fuel vapors at marinas, and fuel permeation through gasoline dispensing hoses and promulgates low sulfur fuel standards for diesel. The Federal Aviation Administration regulates aircraft fuel transfer. The Department of Pesticides adopts strategies on pesticide emissions.

There was discussion of the aggregate emissions reductions from measures considered potentially viable, and whether the inclusion of a criterion regarding toxics reductions affects the ranking of control measures. Ms. Roggenkamp responded that staff does not have an aggregate emission reduction estimate for all of the measures it considered. Mr. Belik added that some of the measures are more promising for toxics reductions. While reducing diesel PM is not a part of ozone control strategy development, it may still offer guidance on giving priority to certain control measures.

Mr. Belik added that the SCAQMD's goal is to inspire CARB to require further reinforcement synthetic rubber fuel line hoses to reduce emissions that occur through permeation. Mr. Kendall added that gasoline dispensing nozzles are tested for disconnect spills, leaks and drips. Recently, staff discovered that some metal nozzles retain liquid prior to being returned to its position on the tank and that fuel evaporates into the atmosphere. Standards have since been adopted regarding this design problem, which affects many, though not all, of the gasoline dispensing nozzles in the Bay Area. Eight million gallons of gasoline are dispensed daily in the Bay Area. Therefore the total emission reduction achieved by such a measure is potentially significant.

In reply to questions on the schedule for implementing these measures in the context of updating the OAP, Ms. Roggenkamp stated staff is now in the process of drafting detailed control measure descriptions. Some measures may fall out of consideration and others may become further study measures. This list will be presented to the Ozone Working Group at the end of March. The next step is to issue the draft OAP in May or June for public discussion. While the deadline to submit the District's plan to attain the state one-hour ozone standard was the end of last year, CARB has informed the air districts that are also working on federal plans that they may submit the updated state plan with their SIP submittal. The District was also to have made an attainment demonstration for the one-hour federal standard in April of this year. However, the last three years of ozone monitoring indicate that the District has an attainment record. If the EPA declares this record to constitute attainment, the District will instead submit an Ozone Maintenance Plan for which there is no deadline. EPA Region IX has expressed its intention to review this matter quickly. However, there is no deadline by which it must render its decision.

5. **Committee Member Comments/Other Business.** There was discussion regarding holding a one-hour meeting of the Technical Committee following the Advisory Council Regular meeting on March 10, 2004. Chairperson Bedsworth stated the Committee had decided at the January 14, 2004 Retreat that it would devote its April meeting to the District's SIP submittal and possibly continue that discussion into June, and then take up issues regarding mobile source emission modeling in the summer and fall, with the winter to be devoted to discussing the connection between local air quality actions and global climate change.

Ms. Roggenkamp observed that in April staff could provide an update to the Air Quality Planning and Technical Committees on the ozone planning process, along with comments on mobile source emission modeling since this category figures into the planning process. Staff could also present which of the potentially viable control measures were included in the update to the OAP.

The Deputy Clerk noted that Chairperson Blake has scheduled Advisory Council member Robert Bornstein, Ph.D., to make a presentation at the March 10 Regular Meeting on real-time emissions monitoring in New York City which is part of an environment and security effort. Mr. Kendall added that for the last year District air monitoring staff has conducted biowatch air monitoring. This is distinct from incident management and accidental releases, for which staff has a number of measures available for field collection data. These include hand-held equipment that collects data on various compounds including sulfur, organics, carbon monoxide, among others, and now the capability has been developed to use this equipment for PM data collection as well.

County and city hazardous materials staff are the first-line responders for these types of emergencies. The District is charged with making measurements and collecting samples from a measurement and air monitoring perspective. However, at the request of a facility, District staff have reviewed Risk Management Prevention Plans. Chairperson Bedsworth inquired if the topics raised by Mr. Kendall could be discussed with Dr. Bornstein's presentation. Mr. Kendall indicated that he and a staff member from the Enforcement Division could attend the meeting and provide input.

6. **Time and Place of Next Meeting.** Tentatively, following the Advisory Council Regular Meeting of March 10, 2004, and as per the Committee schedule developed at the Retreat, 1:30 p.m., Tuesday, April 6, 2004, 939 Ellis Street, San Francisco, California 94109.
7. **Adjournment.** 11:27 a.m.

James N. Corazza  
Deputy Clerk of the Boards

**BAY AREA AIR QUALITY MANAGEMENT DISTRICT**

**Inter-Office Memorandum**

To: Chairpersons Brazil and Bedsworth, PH.D., and Members of the  
Advisory Council Air Quality Planning and Technical Committees

From: Jean Roggenkamp  
Director of Planning and Research

Date: March 25, 2004

Re: Bay Area 2004 Ozone Strategy – Preliminary Draft Control Measure  
Descriptions

**BACKGROUND**

The District, in consultation with the Metropolitan Transportation Commission (MTC) and the Association of Bay Area Governments (ABAG), is preparing the Bay Area 2004 Ozone Strategy. The Ozone Strategy will include all feasible measures for progress toward the State 1-hour ozone standard and will include a redesignation request and maintenance plan for the national 1-hour ozone standard.

District and MTC staff have been evaluating a wide range of potential control measures for inclusion in the Ozone Strategy. The District has evaluated control measures for stationary, mobile and miscellaneous other sources. MTC has taken the lead on evaluating transportation control measures, in consultation with District staff. Based on this analysis, as well as public input, staff have begun developing draft control measures. Preliminary draft control measure descriptions are attached.

**DISCUSSION**

District staff reviewed nearly 400 potential control measures compiled from various sources, including the Ozone Working Group, community meetings, other air districts' regulations and suggestions, District Board members, Advisory Council and staff, members of the public, and previous Bay Area air quality plans. District control measure evaluations identified certain potentially viable measures for stationary, mobile and miscellaneous sources, and staff is now developing draft control measure descriptions for these measures. Preliminary draft control measure descriptions have been completed for the following stationary and mobile source control measures:

- Auto Refinishing
- Boilers Rated Between 5 and 10 MMBTU/HR
- Flares
- High Emitting Spray Booths
- Large Water Heaters and Small Boilers
- Low Emission Vehicles
- Marine Loading Operations
- Organic Liquid Storage Tanks
- Pressure Relief Devices
- Stationary Gas Turbines
- Wastewater Systems
- Wood Products Coating

Work is proceeding on developing descriptions for other potentially viable stationary and mobile source measures, including:

- Gasoline Bulk Terminals and Bulk Plants
- Graphic Arts Operations
- Green Contracting Ordinance
- Polystyrene Resin Operations
- Truck Idling Ordinance

MTC has evaluated a wide range of enhancements to transportation control measures (TCMs). Based on the evaluations and public input, MTC staff, in consultation with District staff, have prepared TCM descriptions. Preliminary draft descriptions have been completed for the following TCMs:

TCM 1	Support Voluntary Employer Based Trip Reduction Programs
TCM 3	Improve Local and Areawide Bus Service
TCM 5	Improve Access to Rail and Ferries
TCM 7	Improve Ferry Service
TCM 8	Construct Carpool/Express Bus Lanes on Freeways
TCM 9	Improve Bicycle Access and Facilities
TCM 12	Arterial Management Measures
TCM 13	Transit Use Incentives
TCM 15	Local Land Use Planning and Development Strategies
TCM 18	Transportation Pricing Reform
TCM 19	Improve Bicycle Access and Facilities
TCM 20	Promote Traffic Calming

Work is proceeding on developing draft descriptions for the remaining seven TCMs:

TCM 4	Improve Regional Rail Service
TCM 6	Improve Interregional Rail Service
TCM 10	Youth Transportation
TCM 11	Install Freeway/Arterial Metro Traffic Operation System
TCM 14	Improve Rideshare/Vanpool Services and Incentives
TCM 16	Intermittent Control Measures/Public Education
TCM 17	Conduct Demonstration Projects

Staff presented the preliminary draft control measure descriptions for public review on the District website and at the March 23, 2004 meeting of the Ozone Working Group. Staff is currently completing the remaining draft control measures, and will invite further public review through the District website and at the May 20, 2004 Ozone Working Group meeting.

In addition to these stationary and mobile source measures and TCMs, staff identified a number of measures that require further study to determine whether they are viable. Potential further study measures include the following:

- Architectural Coatings and Solvents
- Back-up Diesel Generators
- Cooling Water from Coke Cutting Operations
- Emissions from Cooling Towers
- Emission Reductions from Composting
- Encourage Use of Biodiesel Fuel
- Food Product Manufacturing and Processing
- Free Transit on Spare the Air Days
- Glass Melting Furnaces



- Indirect Source Mitigation Program
- Limitations of Solvents Based on Relative Reactivity
- Livestock Waste
- Mitigation Fee Program for Federal Sources
- Refinery Wastewater Ponds
- Restaurant Emissions (Chain-Driven Charbroilers)
- Restaurant Emissions (Under-fire Charbroilers)
- Stationary IC Engines
- Vacuum Trucks

Staff will be available at the April 6, 2004 joint meeting of the Advisory Council Air Quality Planning and Technical Committees to discuss the preliminary draft control measure descriptions.

**Bay Area 2004 Ozone Attainment Strategy**  
**Preliminary Draft Control Measure Descriptions**  
**March 16, 2004**

Introduction

Air District and MTC staff have been evaluating potential control measures for inclusion in the Bay Area 2004 Ozone Strategy. The Air District has evaluated control measures for stationary, mobile and miscellaneous other sources. MTC has taken the lead on evaluating transportation control measures, in consultation with Air District staff.

Staff have presented the evaluations for public review at two meetings of the Ozone Working Group and have made them available on the Air District website. Based on discussions at the OWG, written comments, and further analysis, staff have begun developing draft control measures for inclusion the Draft Ozone Strategy. The attached materials present preliminary draft control measure descriptions. These draft control measure descriptions are still undergoing analysis and review, and thus are preliminary.

Work to date

The Air District control measure evaluations identified 57 potentially viable measures for stationary, mobile and miscellaneous sources. Staff is developing draft control measure descriptions for the potentially viable measures. In most cases, a draft control measure description includes proposals or concepts from more than one suggestion in the evaluation tables, because several suggestions may address the same source category or propose closely related control strategies. Thus, the number of draft control measures is less than the number of suggestions on the evaluations.

Stationary source measures will be implemented through revisions to Air District regulations. Mobile source measures will be implemented through incentive programs and public education programs. Miscellaneous measures will be implemented through public education programs and transportation programs. Preliminary draft control measure descriptions have been completed for the following stationary and mobile source control measures:

- Auto Refinishing
- Boilers Rated Between 5 and 10 MMBTU/HR
- Flares
- High Emitting Spray Booths
- Large Water Heaters and Small Boilers
- Low Emission Vehicles
- Marine Loading Operations
- Organic Liquid Storage Tanks
- Pressure Relief Devices
- Stationary Gas Turbines
- Wastewater Systems
- Wood Products Coating

## ***PRELIMINARY DRAFT Control Measure Descriptions***

Work is proceeding on developing control measure descriptions for the remaining stationary and mobile source measures:

- Gasoline Bulk Terminals and Bulk Plants
- Graphic Arts Operations
- Green Contracting Ordinance
- Polystyrene Resin Operations
- Truck Idling Ordinance

MTC has evaluated enhancements to transportation control measures covering a wide range of travel behavior and systems management concepts. Based on the evaluations and public input, MTC staff, in consultation with District staff, have prepared draft TCM descriptions. The TCMs address State ozone planning requirements for the Bay Area. TCMs adopted by MTC for federal air quality planning will be identified separately in the Ozone Strategy, in the section addressing national ozone planning requirements. TCMs will be implemented through State, regional and local funding processes, incentive programs, outreach and public education, and other programs. Preliminary draft descriptions have been completed for the following TCMs:

TCM 1	Support Voluntary Employer Based Trip Reduction Programs
TCM 3	Improve Local and Areawide Bus Service
TCM 5	Improve Access to Rail and Ferries
TCM 7	Improve Ferry Service
TCM 8	Construct Carpool/Express Bus Lanes on Freeways
TCM 9	Improve Bicycle Access and Facilities
TCM 12	Arterial Management Measures
TCM 13	Transit Use Incentives
TCM 15	Local Land Use Planning and Development Strategies
TCM 18	Transportation Pricing Reform
TCM 19	Improve Bicycle Access and Facilities
TCM 20	Promote Traffic Calming

Work is proceeding on developing draft descriptions for the remaining seven TCMs:

TCM 4	Improve Regional Rail Service
TCM 6	Improve Interregional Rail Service
TCM 10	Youth Transportation
TCM 11	Install Freeway/Arterial Metro Traffic Operation System
TCM 14	Improve Rideshare/Vanpool Services and Incentives
TCM 16	Intermittent Control Measures/Public Education
TCM 17	Conduct Demonstration Projects

### Next Steps

Air District and MTC staff invite public discussion and input on the preliminary draft control measure descriptions. Staff will consider public input, and conduct further analysis where necessary, in order to develop proposed control measures for inclusion in the Draft 2004 Ozone Strategy. Staff also will continue to develop draft control measure descriptions for the remaining potentially viable measures and TCMs, including contingency and other measures required for future federal air quality plans, as necessary. The remaining draft control measure descriptions will be released for public review, no later than the May meeting of the Ozone Working Group.

## **AUTO REFINISHING**

***Suggested Measure Reference # 27, 28, 29***

### **Control Measure Description**

This control measure would reduce ROG emissions from automobile refinishing facilities through lower VOC limits for some categories of coatings based on the comparable South Coast Rule 1151.

### **Background and Regulatory History**

The District regulates ROG emissions from auto refinish operations by setting volatile organic compound (VOC) limits on various types of paints and surface preparation solvents used in auto refinishing. In addition, the amount of some high-VOC coating is limited by a volume relationship with other coatings. This prevents “gaming” by using high-VOC coatings for general, rather than specialized purposes. Also, the rule requires the use of spray technology that is transfer efficient, to minimize the amount of paint that misses or bounces off the intended surface.

Regulation 8, Rule 45: Motor Vehicle and Mobile Equipment Coating Operations, which includes auto refinishing and new and used mobile equipment coating, was adopted in 1989. Auto refinish facilities were previously subject to the less stringent standards in Regulation 8, Rule 4: General Solvent and Surface Coating Operations, which limits facility emissions but not the VOC content of paints. The rule was also amended several times, most significantly in 1994. The emissions from auto refinishing operations (both coating and solvent) have been reduced from over 11 tons per day prior to the implementation of Rule 45 to approximately 3.3 tons per day today.

### **Emissions Subject to Control**

The emissions from auto refinishing are included in the emission inventory as point sources. Any coating operation that uses 30 gallons of coating and solvent per year is required to have a District operating permit, and must submit usage information annually from which emissions are calculated. Auto refinish coating emissions are *Category 274* in the emissions inventory. *Category 275* is solvent used for surface preparation and clean up in auto refinishing and mobile coating operations.

<i>Emissions Subject to Control (TPD, Summer)</i>		
<i>Year</i>	<i>Cat. 274</i>	<i>Cat. 275</i>
2003	2.12	1.21
2006	2.21	1.26

### **Proposed Method of Control**

This proposal draws from two sources, 1) South Coast Rule 1151: Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations, and 2) a draft suggested rule developed by the CAPCOA Enforcement Managers that recommends lower VOC coating and elimination of two coating categories.

Adoption of the South Coast limits was proposed for the 2000 Clean Air Plan and evaluated in the 2001 Ozone Plan for the One Hour Federal Standard RACM Analysis. At that time, an analysis of the lower South Coast limit for clear coatings showed a cost effectiveness of \$35,000 per ton.

However, as costs have come down since that analysis, the potential to reduce emissions at a reasonable cost should be re-examined.

The coating categories proposed for elimination, multi-stage topcoats and specialty coatings, would be replaced by VOC limits for individual coatings that make up the categories. For multi stage topcoats, the individual coatings consist of base coat (or color coat), and clear coat. Although there are often a number of base coats of varying translucency, the base coat/clear coat application form a coating system. Currently, Bay Area Regulation 8, Rule 45: Motor Vehicle and Mobile Equipment Coating Operations, allows averaging of VOC contents of the coatings in the system based on specified formulae for the number of layers of coating used. The VOC limit would be replaced by VOC limits for each type of coating. The other category of coating proposed for elimination is specialty coating. Specialty coating is a catch-all category for any coating that does not fit within the iterated categories. It would be eliminated and replaced with two categories of coating, antiglare or safety coating, and uniform finish coating. Both of these categories would have VOC limits significantly lower than the existing limit for specialty coatings, 840 g/l, but the existing rule constrains use of these coatings whereas the draft suggested rule does not.

Currently, the Stationary Source Division of ARB is conducting a survey of available automotive coatings and plans to analyze the reactivity of coating constituent solvents. The Enforcement Managers' draft has not yet been discussed with the affected industry, nor have emission reductions or cost effectiveness been quantified. At the direction of CAPCOA, the development of a staff report and regulatory proposal will be initiated by the San Joaquin and South Coast districts, with other districts to consider emission reductions based on the results. Any control measure should also consider the results of the ARB survey. It is anticipated that this effort will take at least until mid-2004. Because the auto refinish industry varies little between districts, coordination of statewide efforts is desirable.

### **Emission Reductions Expected**

The emission reduction estimates consider only the implementation of a requirement to use high solids, low VOC clear topcoat. Additional reductions are possible from the elimination of coating categories, however, they cannot be quantified at this time. Furthermore, a reduction in the emissions from associated solvent surface preparation and clean up should be considered. The emissions from implementation of a low-VOC clear coat standard would result in emissions reductions of 33%, or 0.7 tons per day.

### **Costs of Control**

The control costs are based on the cost to the finisher of a high solids low-VOC clear coat, resulting in a reduction in the basecoat/clearcoat coating system or a reduction in the VOC attainable in individual coating categories. Currently, the Bay Area rule allows most coating companies to sell clear coat that has about 420 grams/liter VOC content (3.5 lbs/gal). There is also clear coat available at 250 – 265 g/l VOC content, used sometimes with higher VOC base coats to comply with the average VOC standard for basecoat/clearcoat systems. Due to increased production of low VOC clear coats because of South Coast Rule 1151 that mandates their use, the cost has come down since the 2000 investigation. High solids low-VOC clear coats are now available at lower cost than the conventional material used to meet Bay Area regulations, and the reducer or thinner used is also less expensive. Based on the clear coat alone, on which the emissions reductions are based, adoption of lower VOC standards could now save money. Some other elements of the rule could negate that cost savings, but the rule would still likely be cost effective.

## **Other Impacts**

No significant adverse environmental impacts are expected as a result of the adoption of this control measure. The affected industry is already regulated and proposed changes in paint formulations will not be implemented in a way that will add to waste streams or impact other media.

## **References**

South Coast Rule 1151: Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations, and staff report dated 12/11/98  
2001 Ozone Plan for the One Hour Federal Standard RACM Analysis  
Bay Area Regulation 8, Rule 45: Motor Vehicle and Mobile Equipment Coating Operations  
CAPCOA Enforcement Managers' Automotive Coatings Model Rule, Final Draft, 7/19/02  
e-mail communication with Barb Fry, ARB Stationary Source Division, 5/20/03

## **BOILERS RATED BETWEEN 5 AND 10 MMBTU/HR**

**Suggested Measure Reference # 46, 47, 48, 49, 55**

### **Control Measure Description**

This control measure would reduce emissions of nitrogen oxides (NO<sub>x</sub>) from boilers by extending controls to boilers smaller than those currently regulated by Bay Area Regulation 9, Rule 7.

### **Background and Regulatory History**

The District regulates NO<sub>x</sub> emissions from boilers under three separate rules, all of which were adopted pursuant to California Air Resources Board (CARB) pollution transport regulations (California Code of Regulations beginning at section 70600). Each BAAQMD boiler rule regulates a different category of boilers. BAAQMD Regulation 9, Rule 7 imposes a 30 ppm NO<sub>x</sub> limit on industrial, institutional, and commercial boilers with a rated heat input of 10 million BTU/hr or more. Regulation 9, Rule 10 imposes a slightly more stringent NO<sub>x</sub> limit equivalent to 28 ppm on refinery boilers with a rated heat input of 10 million BTU/hr or more. Regulation 9, Rule 11 applies to extremely large boilers used to generate electricity and imposes a NO<sub>x</sub> limit equivalent to 15 ppm on boilers with a rated heat input of 250 million BTU/hr or more.

The small boilers to which this measure applies are generally sold as “package boilers” that are equipped and shipped complete with burners, automatic controls and accessories, and mechanical draft equipment. They are generally used in high-rise office buildings, large hotels, and some industrial facilities to supply heat, steam, or hot water. A small number of boiler manufacturers – Ajax, Bryan, Cleaver-Brooks, Kewanee, Teledyne Laars, Parker, Peerless, Rite, and Thermo Pak – manufactured most of the boilers of this size installed in San Francisco.

### **Emissions Subject to Control**

Boiler emissions are included in the BAAQMD inventory in several different categories. Emissions from boilers at power plants are found in the category called *fuels combustion – power plants*. Emissions from boilers at refineries are found in the category called *fuels combustion – oil refineries external combustion*.

The emissions from other boilers, including smaller boilers not already subject to the existing BAAQMD rules, are included in the emission inventory source category called *fuels combustion – other external combustion*. This category includes external combustion sources such as boilers, furnaces, space heaters, and ovens. Boilers already subject to Regulation 9, Rule 7 have air quality permits, and emissions from these boilers are included in the point source portion of this category. Most emissions from the smaller boilers that are the target of this control measure are included in the area source portion of this inventory category (the exception would be small boilers located at facilities required to have a permit for other reasons). These area source emissions are estimated by subtracting fuel usage by the point sources from total fuel usage as obtained from fuel consumption data. Emissions in this category are estimated to be 15.78 tons of NO<sub>x</sub> per day for 2003.

To determine more precisely the emissions within the *other external combustion* inventory category that are attributable to Bay Area boilers in the size range subject to this measure, data from a boiler database developed by the San Francisco Department of Building Inspection (DBI) was used. Although San Francisco's population represents about one-tenth of the Bay Area total population, it represents about one-fourth of the population in heavily urbanized areas. This is important because

boilers are not generally found in suburban areas except at laundries, some light industrial locations, and some schools. The San Francisco boiler population was therefore multiplied by 5 and rounded to arrive at boiler population estimates for the entire Bay Area.

Based on the DBI database, there are an estimated 420 boilers with a capacity greater than 5 million Btu/hr and less than or equal to 10 million Btu/hr in the Bay Area. Total estimated NO<sub>x</sub> emissions from these boilers are set forth below. Future-year emissions in this small boiler sub-category have been derived using the same growth factors used in the broader *fuels combustion – other external combustion* inventory category.

<u>Year</u>	<u>Emissions Subject to Control (TPD, Summer)</u>
2003	1.90
2006	1.99

Note that these emission estimates are likely to change during rule development as better population and emissions information becomes available. For example, Bay Area boiler service companies have indicated that estimates based on the DBI database may significantly understate the numbers of boilers for this particular size range.

### **Proposed Method of Control**

This measure would extend the NO<sub>x</sub> limit of 30 ppm found in Regulation 9, Rule 7 to smaller boilers in the 5 to 10 million BTU/hr range. Control would generally be achieved by installation of low-NO<sub>x</sub> burners. A more stringent standard may be possible depending upon the performance of generally available low-NO<sub>x</sub> burners. Low-NO<sub>x</sub> burners are available on new boilers manufactured by most of the major boiler manufacturers. In addition, low-NO<sub>x</sub> burners are available as retrofits for some models, and virtually all of these retrofits are claimed to achieve NO<sub>x</sub> levels of 30 ppm or less. For many models, however, low-NO<sub>x</sub> retrofits are unavailable.

### **Emission Reductions Expected**

The maximum total estimated NO<sub>x</sub> emission reduction that could be achieved, assuming retrofit of all boilers in this size range, would be 1.44 tons per day. However, emission reductions are likely to be significantly lower because many of the boilers in this size range are used for space heating. Annual usage of boilers used for space heating is relatively low, and installation of controls is not likely to be cost effective. For this reason, most boiler rules, including BAAQMD Regulation 9, Rule 7, exempt boilers with low annual usage (less than 90,000 therms). Up to 80% of boilers in this size range may be exempt, based on data developed by the Sacramento Metropolitan AQMD.

Available emission reductions are likely to be in the range from 0.5 to 1.0 tons per day. On the other hand, emission reductions could be higher if the number of boilers is found to be higher than currently estimated or if available low-NO<sub>x</sub> burners are generally capable of meeting a standard more stringent than 30 ppm. Any emission reductions could probably be achieved in a cost-effective manner only over a period of at least 5 years, given the likelihood that low-NO<sub>x</sub> burner retrofits will be unavailable for many existing boilers. Most air districts have allowed boiler operators at least 5 years to achieve similar emission limits.



## **Costs of Control**

Installation of low-NO<sub>x</sub> burners is expected to have a cost effectiveness of \$5000 per ton or better based on cost data developed by the South Coast AQMD during development of its Rule 1146.1 and by the Ventura County APCD during development of its Rule 74.15.1. For boilers with low annual usage, controls would be much less cost effective than \$5000 per ton.

## **Other Impacts**

Bay Area NO<sub>x</sub> reductions may reduce ambient levels of fine particulate pollution, because some fraction of the NO<sub>x</sub> emissions is ultimately converted to nitrate particles in the atmosphere. However, these reactions are not currently well understood and are difficult to quantify.

Minor adverse environmental impacts may occur as a result of this control measure. Photochemical modeling from the 1980's and 1990's and recent ambient measurements indicate that Bay Area NO<sub>x</sub> reductions are likely to cause an increase in localized Bay Area ozone levels. In addition, ambient measurements suggest an emerging "ozone weekend effect" in the Sacramento area that may mean Bay Area NO<sub>x</sub> reductions are counterproductive in reducing downwind ozone. Further information on the benefits and disbenefits of Bay Area NO<sub>x</sub> reductions may come from photochemical modeling associated with the Central California Ozone Study.

Some NO<sub>x</sub> technologies may adversely affect boiler turndown, capacity, CO levels, or efficiency. Rule provisions should be designed to avoid, for example, efficiency decreases and resulting increases in fuel use that might come from widespread use of boiler derating, water or steam injection, or burners modified to reduce flame temperatures.

BAAQMD air quality permits are not currently required for boilers with an input capacity smaller than 10 million BTU/hr unless they also fire liquid fuels. To implement this control measure, amendments to BAAQMD Regulation 2, Rule 1 to require permits for small boilers would probably be necessary. If boilers in the 5 to 10 million BTU/hr range are as numerous as boiler service companies suggest, the administrative burden for the District could be significant.

## **References**

- Blanchard, C., Tanenbaum, S. "Characterization of CCOS Intensive Operating Periods: Task 4c. Supplemental Analyses: Corroborative Analysis" (paper prepared by Envair for the Central Coast Ozone Study/ARB, 2001)
- Marr, L.C., Harley, R.A. 2002. "Spectral analysis of weekday-weekend differences in ambient ozone, nitrogen oxide, and non-methane hydrocarbon time series in California." *Atmospheric Environment* 36, 2327-2335.
- San Francisco Department of Building Inspection. 2003. Personal communication from DBI forwarding boiler data extracted from DBI database into Excel spreadsheet.
- San Joaquin Unified APCD. 2003. "Final Draft Staff Report: Proposed Amendments to Rule 4305 (Boilers, Steam Generators, and Process Heaters - Phase 2) and Rule 4351 (Boilers, Steam Generators, and Process Heaters - Phase 1); New Rule 4306 (Boilers, Steam Generators, and Process Heaters - Phase 3)"
- San Joaquin Unified APCD. Rules 4305, 4351, and 4306.
- South Coast AQMD. 2001. "Potential Backstop Rule for Regulation XX - Regional Clean Air Incentive Market (RECLAIM)." Report to SCAQMD Board, November 9, 2001.
- South Coast AQMD. 2000. "Staff Report: Proposed Amended Rule 1146 - Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters."

***PRELIMINARY DRAFT Control Measure Descriptions***

South Coast AQMD. 1997. "Final Staff Report for: Proposed Amended Rule 1146.2 - Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers."

South Coast AQMD. Rules 1121, 1146, 1146.1, and 1146.2.

Texas Council on Environmental Quality. 1999. Rule Log. No. 1999-055I-117-AI, available at [www.tnrcc.state.tx.us/oprd/rul-lib/pa99055i.pdf](http://www.tnrcc.state.tx.us/oprd/rul-lib/pa99055i.pdf).

Texas Administrative Code, Title 30, Chapter 117 - Control of Pollution from Nitrogen Compounds.

TIAX LLC. 2004. "Control Measure Number: D-16 Bay Area: Boilers, Steam Generators, and Process Heaters/Space Heaters" Control measure suggested for the Bay Area by Sacramento Metropolitan AQMD/TIAX based on control measure D-16 developed by TIAX for the Sacramento region.

U.S. EPA. 1994. "Alternative Control Techniques Document - NO<sub>x</sub> Emissions from Industrial, Commercial, Institutional (ICI) Boilers." EPA document no. EPA-453/R-94-022.

## **FLARES**

**Suggested Measure Reference # 26, 31, 42**

### **Control Measure Description**

This control measure would reduce ROG emissions from flares in petroleum refineries and chemical plants.

### **Background and Regulatory History**

Flares in refineries provide for the safe disposal of liquid and gaseous hydrocarbons that are either automatically vented from process units through pressure safety valves, control valves or manually drawn from units. Blowdown systems gather hydrocarbon flow, separate liquid from gases, recover condensable oil and water, and discharge the gases to be combusted at the flare.

The 2001 Ozone Attainment Plan contained two measures related to flaring operations at petroleum refineries. Control measure SS-15 included a commitment to adopt a regulation requiring monitoring of flows to flares and calculation of emissions from flares. On May 21, 2003, the Bay Area adopted new Regulation 12, Rule 11: Flare Monitoring at Petroleum Refineries. Further study measure FS-8 in the 2001 Ozone Plan committed the District to assess the viability of controlling flare emissions at petroleum refineries. In December, 2002 a draft technical assessment document was completed that recommended that routine flaring could be minimized by equipment control strategies or by pollution prevention strategies.

### **Emissions Subject to Control**

Emissions from flares at petroleum refineries are reported in Category 15 in the emissions inventory, *Flares and Blowdown Systems*. The emissions inventory for this category is derived from the calculated emissions based on data analyzed during the development of the 2001 Ozone Plan and incorporated into the emissions inventory. The base year for these data is 1999.

<i>Emissions Subject to Control (TPD, Summer)</i>	
<i>Year</i>	<i>Cat. 15 Flares and Blowdown Systems</i>
2003	13.78
2006	14.36

Current 2003 data shows that the volume of flare gas sent to flares has been reduced by over 50% from 2001 and 2002. This reduction can be attributed to two things: 1) the installation at one refinery of new compressors with sufficient capacity to halt routine flaring at that refinery, and 2) greater attention to operating practices at refineries that have minimized the need for flaring. Also, improvements in flow monitors and better gas composition information are helping to replace engineering assumptions made for the 2001 Ozone Plan with refined data and better emission estimates.

### **Proposed Method of Control**

Flaring in refineries can be roughly categorized as being one of three types, routine flaring as part of petroleum product manufacturing, flaring during startups and shutdowns of process units, and

flaring during process upsets and emergencies. The reductions already achieved in flaring are primarily the result of reduced routine flaring. Flares exist as emissions controls and safety devices that function during upsets, unanticipated breakdowns of pressurized equipment, or unforeseen events such as power outages. Either by carefully controlling processes, including startup and shutdown, or by equipment modifications, some flaring may be able to be eliminated.

The December 2002 draft technical assessment document concluded that routine flaring could be minimized by equipment control strategies or by pollution prevention strategies. Equipment control strategies require the installation of new equipment or devices and can include physical changes to the flare system. Potential equipment control strategies include: 1) installation of additional flare gas compressors, 2) improvement in the reliability of existing flare gas compressors, and 3) addition of gas storage capacity to hold flare gas. Pollution prevention strategies eliminate the likelihood of flaring by changes in operation or process design. Pollution prevention strategies can include the installation of redundant equipment and devising monitoring and maintenance programs to reduce the need for flaring.

### **Emission Reductions Expected**

Emissions from flares fluctuate on a daily, monthly and yearly basis. The emission inventory estimates developed for the 2001 Ozone Plan are not expected to be consistent with present or future estimates. An estimate of emission reductions for this control measure will be based on an analysis of reductions already achieved and any further regulatory controls.

### **Costs of Control**

Equipment control strategy costs can vary greatly depending on the specifics of each refinery. Flare gas compressors cost between one and eight million dollars depending on the size of the compressor. Also, additional gas storage capacity or equipment to process the gas may need to be installed. Costs for operational controls or process changes that could minimize flaring may have economic benefits. Costs of this proposed control measure will be determined as part of the rule development process.

### **Other Impacts**

Flares act to burn gases released from process units to avoid fires or explosions. As long as safety considerations are not compromised, significant adverse environmental impacts are not expected as a result of adding equipment to process flare gas or making changes to minimize flaring. Large flaring events are of particular concern to communities around refineries. Implementation of this measure may reduce public exposure to emissions from these events. The affected flare systems are part of existing refinery operations, so that additional equipment added to these systems will not cause additional impacts. However, to the extent that additional control equipment is required, there may be an increase in incineration technology used to abate emissions. Incineration and flares both generate NO<sub>x</sub> emissions.

### **References**

Technical Assessment Document, Further Study Measure 8, Flares, BAAQMD, Dec. 2002

## **HIGH EMITTING SPRAY BOOTHS**

***Suggested Measure Reference # 35, 37***

### **Control Measure Description**

This control measure would reduce ROG emissions from coating operations that emit in excess of 20 tons of emissions per year. It would require a reduction beyond the use of coatings that comply with existing District rules. Spray booths or enclosed coating operations could be abated to meet a standard based on a percent reduction requirement, or alternative lower emitting coating technology could be sought.

### **Background and Regulatory History**

The District regulates industrial and commercial coating through industry or substrate specific rules. Due to the vast number of coating applications, fifteen of the fifty District organic compound rules affect these types of coating applications. Each rule sets specific volatile organic compound content (VOC) limits on various types of inks, coatings or adhesives, although the option exists in each rule to meet the VOC limits by the use of add on control technology. In addition, Regulation 2, Rule 2: New Source Review, requires the use of Best Available Control Technology (BACT) for new or modified sources that emit more than 10 pounds of organic compounds per day. For larger coating sources, BACT has required installation of abatement technology. Consequently, some of the sources that would be subject to this control measure would already meet the mandates for additional control. The South Coast has already implemented this control measure. Rule 1132: Further Control of VOC Emissions from High Emitting Spray Booth Facilities, is derived from the South Coast's 1999 AQMP, control measure CTS-09. Rule 1132 requires coating facilities that emit 20 tons of VOC per year from spray booths to reduce emissions by 65% from a 2001 baseline, primarily through the installation of abatement equipment, although alternative compliance options exist.

### **Emissions Subject to Control**

There are 12 facilities in the Bay Area that do surface coating that emit 20 tons VOC per year. Of these, 47% of the total emissions are from 2 facilities, New United Motors Manufacturing in Fremont and Ball Metal Beverage Container in Richmond. Five of the facilities, including New United Motors and Ball Metal, are already abated, so emissions are controlled to at least the extent required by the South Coast rule. Of the remaining seven facilities, one is a mobile equipment manufacturer, one is a can manufacturer, one a foundry that has a significant coating source, two are metal parts manufacturers, and two are wood furniture companies.

Because this rule is source specific rather than source category or industry specific, the emissions are found in several source categories in the emission inventory. It is more appropriate to look at specific facilities that would be subject to the rule. The following table shows emissions on a facility by facility basis. *Emissions Subject to Control* consists of the emissions from specific sources at Bay Area facilities that emit 20 tons or organic compounds per year in each of the source surface coating source categories from the emissions inventory.

<i>Facility</i>	<i>Emissions Subject to Control</i>	<i>Potential Reduction at 65%</i>
1	139 lb/day	90 lb/day
2	431 lb/day	280 lb/day

## ***PRELIMINARY DRAFT Control Measure Descriptions***

3	379 lb/day	246 lb/day
4	212 lb/day	138 lb/day
5	175 lb/day	114 lb/day
6	118 lb/day	77 lb/day
7	125 lb/day	81 lb/day

The emissions total 0.79 tons per day and the reduction, assuming 65% control could be achieved on all operations, is approximately 0.5 tons/day.

### **Proposed Method of Control**

The Bay Area, like the South Coast, has numerous rules that affect commercial and industrial coating operations. Some, such as Wood Products Coating and Automotive Refinish Coating, have already been identified for emission reductions (see Wood Products Coating and Auto Refinishing Control Measure Descriptions, respectively). Others, such as aerospace coating, have very small inventories or, such as can and coil coating, already have emissions largely controlled by abatement technology. For coating categories for which there is sufficient inventory and technical evidence that emissions can be further reduced, staff will continue to pursue emission reduction opportunities. However, this control measure is directed at various source categories at the highest emitting facilities. If emissions are sufficient, it is considered to be cost effective to abate emissions instead of reduce solvent content in coating materials. A 65% reduction requirement would also allow alternative coating technology such as ultraviolet cured coatings or very low VOC water based technology.

Several air pollution control devices are available to reduce VOC emissions from spray booths. They include commonly used control technologies such as carbon or zeolite adsorption, and thermal or catalytic oxidation, and newer technologies such as biofiltration, cryogenic condensation, ultraviolet oxidation, and hybrid concentrator/oxidation systems. A 65% reduction, as specified by the South Coast rule, could be achieved by any of these technologies.

### **Emission Reductions Expected**

The South Coast rule only applies to emissions from spray booth operations, and exempts booths with air flows that have a low VOC concentration because control of these booths is much less cost effective. The South Coast staff report estimates that, due to this exemption, emission reductions are about 15% less than they would have been had all sources had to reduce emissions by 65%. Based on the seven currently unabated Bay Area facilities with coating emissions of 20 tons per year, and assuming a 15% of the emissions would be exempted from the requirement due to cost or technical problems, an emissions reduction of approximately 0.3 tons per day could be achieved.

### **Costs of Control**

The South Coast estimates that the cost effectiveness for control of spray coating operations subject to the rule is about \$5484 per ton of emission reduction. The 20 ton per year threshold may be adjusted to improve rule effectiveness and cost-effectiveness.

### **Other Impacts**

No significant adverse environmental impacts are expected as a result of the adoption of this control measure. The affected coating operations are part of existing industrial operations, so that an addition of emissions control equipment will not cause additional impacts. The proposed control

option, however, will add emissions of NO<sub>x</sub> to the atmosphere if incineration is the preferred technology to comply with the proposal.

**References**

CST-10: Miscellaneous Industrial Coatings and Solvent Operations, South Coast 2003 Air Quality Management Plan, SCAQMD

Rule 1132: Further Control of VOC Emissions from High Emitting Spray Booth Facilities, and staff report, SCAQMD, 1/2001

## **LARGE WATER HEATERS AND SMALL BOILERS**

**Suggested Measure Reference # 46, 47, 48, 49, 51, 52, 53, 57**

### **Control Measure Description**

This control measure would reduce emissions of nitrogen oxides (NO<sub>x</sub>) from water heaters larger than those currently regulated by BAAQMD rules and boilers smaller than those currently regulated by BAAQMD rules. NO<sub>x</sub> limits would be imposed on units with a rated heat input capacity greater than 75,000 BTU/hr and less than or equal to 2 million BTU/hr.

### **Background and Regulatory History**

The District regulates NO<sub>x</sub> emissions from water heaters under Regulation 9, Rule 6, which imposes a NO<sub>x</sub> limit of 40 nanograms NO<sub>x</sub> per joule of heat output on water heaters with a rated heat input capacity of 75,000 BTU/hr or less. The regulated water heaters are conventional tank water heaters typically found in single-family residences.

Boilers are regulated under three separate rules. Two rules apply to large industrial boilers at refineries and power plants (Regulation 9, Rules 10 and 11, respectively). The third rule, Regulation 9, Rule 7, imposes a 30 ppm NO<sub>x</sub> limit on industrial, institutional, and commercial boilers with a rated heat input of 10 million BTU/hr or more. Control measure SS-[fill in number] proposes to extend the Regulation 9, Rule 7 limits to smaller boilers with a capacity of from 5 to 10 million BTU/hr.

The water heaters to which this measure applies are tank type water heaters similar in appearance, design, and construction to the smaller water heaters subject to Regulation 9, Rule 6. These large water heaters range in size between 75,000 and 400,000 BTU/hr and are used in small hotels, apartment buildings, office buildings, and industrial and commercial facilities to supply hot water.

Units larger than 400,000 BTU/hr are typically small boilers and are different in appearance, design, and construction from water heaters. The small boilers to which this measure applies are generally sold as “package boilers” that are equipped and shipped complete with burners and controls. Boilers in this size range generally rely on natural draft rather than mechanical draft equipment. They are used in office buildings, hotels, schools, and industrial facilities to supply heat, steam, or hot water.

### **Emissions Subject to Control**

Emissions from these units along with emissions from many other types of combustion equipment are included in the BAAQMD inventory in two different categories. Some emissions from water heaters are included in the emission inventory source category called *fuels combustion – domestic*. Combined emissions from all types of equipment in this category are estimated to be 8.33 tons of NO<sub>x</sub> per day for 2003. Emissions from non-residential water heaters and boilers are included in the source category called *fuels combustion – other external combustion*, which includes external combustion sources such as boilers, furnaces, space heaters, and ovens. Emissions in this category are estimated to be 15.78 tons of NO<sub>x</sub> per day for 2003.

To determine more precisely the emissions attributable to Bay Area water heaters and boilers in the size range subject to this measure, data from a boiler database developed by the San Francisco Department of Building Inspection (DBI) was used. Although San Francisco's population represents about one-tenth of the Bay Area total population, it represents about one-fourth of the



population in heavily urbanized areas. This is important because large water heaters and boilers are not generally found in suburban areas except at laundries, some light industrial locations, and some schools. The San Francisco boiler population was therefore multiplied by 5 and rounded to arrive at water heater and boiler population estimates for the entire Bay Area.

Based on the DBI database, there are an estimated 12,300 water heaters with a capacity from 75,000 to 400,000 Btu/hr in the Bay Area. The number of boilers with a capacity over 400,000 BTU/hr and up to 2 million BTU/hr is estimated at 10,500. Total estimated NOx emissions from these water heaters and boilers are set forth below. Future-year emissions for these units have been derived using the same growth factors used in the *fuels combustion – other external combustion* inventory category.

<u>Year</u>	<u>Emissions Subject to Control (TPD, Summer)</u>
2003	5.30
2006	5.54

Note that these emission estimates are likely to change during rule development as better population and emissions information becomes available.

### **Proposed Method of Control**

This measure would impose a NOx limit of 40 nanograms per joule of heat output as found in Regulation 9, Rule 6 on large water heaters with a capacity greater than 75,000 BTU/hr and less than or equal to 400,000 BTU/hr. For boilers larger than 400,000 BTU/hr and less than or equal to 2 million BTU/hr, the measure would impose the NOx limit of 30 ppm found in Regulation 9, Rule 7. All limits would apply to new units only. These limits would be identical to limits for new units adopted by the Santa Barbara County APCD (SBCAPCD Rule 360). Water heaters and boilers with burners capable of meeting these NOx limits are widely available from numerous manufacturers.

Rather than impose the limits only on new units, the South Coast AQMD adopted retrofit requirements (in Rule 1146.2) for units with a capacity between 400,000 BTU/hr and 2 million BTU/hr. However, because operators of the units were given approximately 10 years to comply, the requirements are similar in effect to those adopted by the Santa Barbara APCD. In addition, South Coast AQMD staff have reported a non-compliance rate of 80% with rule limits for units subject to RECLAIM. In addition, it appears that retrofits are unavailable for most of these smaller units.

### **Emission Reductions Expected**

The total estimated NOx emission reduction that could be achieved, assuming a 10 year life expectancy for these units and replacement of all units with complying units by the end of the 10-year period, would be 3.9 tons NOx per day. This emission reduction would be achieved year-by-year over the 10-year period as new units replace existing units.

### **Costs of Control**

Based on cost data developed by the South Coast AQMD during development of its Rule 1146.1, cost effectiveness is expected to range from a net cost savings (due to higher efficiency of low-NOx units) to approximately \$3,000 per ton of NOx reduced.

## **Other Impacts**

Bay Area NO<sub>x</sub> reductions may reduce ambient levels of fine particulate pollution, because some fraction of NO<sub>x</sub> emissions is ultimately converted to nitrate particles in the atmosphere. However, these reactions are not currently well understood and are difficult to quantify.

Burners used to comply with the control measure may reduce energy usage. Low-NO<sub>x</sub> burners have higher thermal efficiencies than conventional units. Energy savings from use of low-NO<sub>x</sub> units may be as high as 20%.

Minor adverse environmental impacts may occur as a result of this control measure. Photochemical modeling from the 1980's and 1990's and recent ambient measurements indicate that Bay Area NO<sub>x</sub> reductions are likely to cause a localized increase in Bay Area ozone levels. In addition, ambient measurements suggest an emerging "ozone weekend effect" in the Sacramento area that may mean Bay Area NO<sub>x</sub> reductions are counterproductive in reducing downwind ozone. Further information on the benefits and disbenefits of Bay Area NO<sub>x</sub> reductions may come from photochemical modeling associated with the Central California Ozone Study.

Some NO<sub>x</sub> technologies may adversely affect boiler turndown, capacity, CO levels, or efficiency. Rule provisions should be designed to avoid, for example, efficiency decreases and resulting increases in fuel use that might come from widespread use of boiler derating, water or steam injection, or burners modified to reduce flame temperatures.

BAAQMD air quality permits are not currently required for these water heaters and boilers and would not be required for implementation of this measure. NO<sub>x</sub> limits for these units would be enforced through a sales and installation prohibition. The District would enforce the sales ban at the distributor level, and local building departments would prohibit installation of heaters that do not comply with rule requirements. Implementation of the measure is not expected to impose a significant administrative burden for the District.

## **References**

- Blanchard, C., Tanenbaum, S. "Characterization of CCOS Intensive Operating Periods: Task 4c. Supplemental Analyses: Corroborative Analysis" (paper prepared by Envair for the Central Coast Ozone Study/ARB, 2001)
- Marr, L.C., Harley, R.A. 2002. "Spectral analysis of weekday-weekend differences in ambient ozone, nitrogen oxide, and non-methane hydrocarbon time series in California." *Atmospheric Environment* 36, 2327-2335.
- San Francisco Department of Building Inspection. 2003. Personal communication from DBI forwarding boiler data extracted from DBI database into Excel spreadsheet.
- Santa Barbara County APCD. Rule 360.
- South Coast AQMD. 2001. "Potential Backstop Rule for Regulation XX - Regional Clean Air Incentive Market (RECLAIM)." Report to SCAQMD Board, November 9, 2001.
- South Coast AQMD. 1997. "Final Staff Report for: Proposed Amended Rule 1146.2 - Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers."
- South Coast AQMD. Rule 1146.2.

## **Low-Emission Vehicles**

**Suggested Measure Reference # 1,3,4,7,9,11,12,13,16**

### **Background**

The purpose of this measure is to encourage the use of low-emission vehicles that have emissions that are significantly lower than the standards established for vehicles of similar make and model year. Low-emission vehicles typically have cleaner burning engines, fuels and/or exhaust treatment devices. The District funds low-emission vehicle projects through the Transportation Fund for Clean Air (TFCA), Carl Moyer Program and other funding sources. TFCA enabling legislation identifies “low-emission and zero-emission vehicle programs” as one of the project categories eligible for TFCA funding. The legislation further requires that to be eligible for funding, control measures such as low-emission vehicle programs, must also be included in the plans for attainment of state or federal ambient air quality standards, such as this Ozone Strategy. This measure clarifies the types of low-emission vehicle projects that would be eligible for TFCA funds and other District grant programs.

### **Regulatory History**

The authority of air districts to regulate the use of low-emission vehicles in fleets is currently being argued before the US Supreme Court. To increase the use of low-emission vehicles, the District uses financial incentives. The District currently provides incentives to reduce mobile source emissions through the TFCA and Carl Moyer Programs. Section 44220 of the California Health and Safety Code allows the District to collect funds through a motor vehicle registration surcharge to carry out “low-emission and zero-emission” projects that are also contained in a State ambient air quality attainment plan, such as this Ozone Strategy. Chapter 9 of the California Health and Safety Code contains the enabling legislation for the Carl Moyer Program. The Carl Moyer Program provides funds on an incentive-basis for the incremental cost of cleaner-than-required on-road and off-road engines and equipment.

### **Emissions Subject to Control**

This control measure would achieve emission reductions from low-emission vehicle programs that include all vehicle weights (i.e. light, medium and heavy-duty) and on-road and off-road sources. This control measure would allow TFCA funding of low-emission vehicles, engine repowers and retrofits, exhaust treatments, clean fuels or additives, and the infrastructure to supply alternative fuels. The projected ROG and NO<sub>x</sub> emissions subject to control are provided below.

<b><i>Emissions Subject to Control</i></b>		
<b><i><u>Year</u></i></b>	<b><i><u>ROG (TPD)</u></i></b>	<b><i><u>NO<sub>x</sub> (TPD)</u></i></b>
2003	163	305
2006	137	263
2009	115	223

### **Proposed Method of Control**

This control measure is intended to increase the share of low-emission vehicles in the on-road and off-road fleet. TFCA funds and other District grant programs would be used to provide an incentive to:

- Purchase low- or zero-emission vehicles or engines,

- Engine repowers, retrofits and replacements,
- Exhaust treatments and add-on equipment,
- Clean fuels or additives, and
- Infrastructure to supply alternative fuels.

### **Emission Reductions Expected**

Emission reductions expected from this measure would be achieved by the incremental lower emissions from replacement of conventional vehicles, engines and fuels with low-emission vehicles, engines and fuels. Emission reductions would be limited by available TFCA and other District grant program funds, availability of vehicles and infrastructure, and the ability of projects to compete for the funds. In FY 02/03, TFCA funds were used to fund low-emission vehicle projects that achieved an estimated 230 tons of emission reductions (ROG, NOx and PM combined) over the life of the projects.<sup>1</sup> The average cost-effectiveness of these projects was approximately \$28,800/ton of emissions reduced. In FY 00/01, the Carl Moyer Program achieved a cost-effectiveness of less than \$2,000 per ton of NOx reduced.

### **Emission Reductions**

<u>Year</u>	<u>ROG (TPD, Summer)</u>	<u>NOx (TPD, Summer)</u>
2003	0.03	0.6
2006	0.03	0.6
2009	0.03	0.6

### **Cost of Controls**

The cost of this measure is dependent on many factors, such as the incremental cost of low-emission vehicles, engines, fuels and exhaust treatment devices compared to conventional vehicles, engines, fuels and exhaust treatment devices. In FY 02/03, approximately \$6.6 million in TFCA funds were used for projects identified under this control measure. In 2003, the Carl Moyer Program allocated \$1.8 million to projects identified under this control measure.

### **Other Impacts**

It would be necessary to minimize leaks and losses of natural gas during handling, as methane is 30 times more potent than CO<sub>2</sub> as a greenhouse gas. Increased use of natural gas and electric vehicles would reduce U.S. dependency on imported petroleum.

---

<sup>1</sup> From TFCA Annual Report on FY 02/03 Allocations and Effectiveness

## **MARINE LOADING OPERATIONS**

***Suggested Measure Reference # 26, 36***

### **Control Measure Description**

This control measure would further reduce ROG emissions from marine loading operations by controlling currently unregulated cargoes, requiring more stringent emission limitations, and/or controlling housekeeping operations such as tank washing, tank venting or gas freeing aboard marine vessels that result in ROG emissions.

### **Background and Regulatory History**

Regulation 8, Rule 44: Marine Vessel Loading Terminals and Regulation 8, Rule 46: Marine Tank Vessel to Marine Tank Vessel Loading were both adopted in 1989. Reg 8-44 limits precursor organic emissions (ROG) from loading specified organic liquids at marine terminals or from the loading of tank vessels that previously contained these organic liquids. Reg 8-44 affects mostly petroleum refineries, chemical plants, bulk terminal distribution facilities, and shipping companies. Reg 8-46 applies to marine vessel to marine vessel loading operations, termed lightering. Regulation 8, Rule 44 and Rule 46, currently require control of specified organic liquids: gasoline, gasoline blending stocks, aviation gas, JP-4 aviation fuel, and crude oil. The existing emission standard in these rules for loading operations is 2 pounds of precursor organic compound emissions per thousand barrels of organic liquid loaded, or a 95% reduction in emissions.

In the 2001 Ozone Attainment Plan for the San Francisco Bay Area, the District committed to study the viability of further controls on marine vessel loading and marine tank vessel activities in Further Study Measure 11. A draft technical assessment document was completed in December, 2002. The document recommends several changes to Bay Area Regulation 8, Rules 44 and 46 and concludes that there are viable strategies to further control emissions from these operations. In addition, the technical assessment document recommends changes to the emissions inventory to better account for emissions from unregulated cargo.

### **Emissions Subject to Control**

Emissions from marine vessels are divided into several categories in the emissions inventory. Categories 86 and 87 are ship and barge lightering, respectively. Categories 88, 89, and 90 are the emissions from vessel ballasting, the loading of water into a tank that contains organic vapors from crude oil, gasoline and other organic liquids, respectively. Category 91 is for cleaning and gas freeing of vessels. Categories 795 through 798 are the emissions at marine terminals at the refineries from the loading and unloading of crude oil and gasoline (including other products) in tankers and barges. Categories 799 through 802 are the emissions from the loading and unloading of crude oil and gasoline in tankers and barges at locations other than the petroleum refineries.

*ROG Emissions Subject to Control (TPD, Summer)*  
*Categories*

<i>Year</i>	<i>86, 87</i>	<i>88, 89, 90</i>	<i>91</i>	<i>795, 796, 797, 798</i>	<i>799, 800, 801, 802</i>
2003	0.07	1.40	0.56	0.25	0.36
2006	0.07	1.52	0.60	0.25	0.39

The reactive organic (ROG) emissions from these activities total 2.64 tons per day in 2003 and 2.83 tons per day in 2006.

The technical assessment document prepared in December, 2002 includes the results of source tests conducted on unregulated cargo. The results of these tests are not yet incorporated into the inventory data shown above.

### **Proposed Method of Control**

Further study measure FS-11 from the 2001 Ozone Attainment Plan looks at the potential to control currently unregulated cargo, or further limit emissions from marine loading activities. Marine loading and ballasting are already limited by the standards in Bay Area Regulation 8, Rule 44 and 46. In December, 2002, Bay Area staff released a draft technical assessment document (TAD). Source tests conducted in development of the TAD found a number of cargoes that are currently not subject to the rule that had significant emissions that resulted from loading.

The technical assessment document contains three recommendations: 1) a requirement that cargoes be controlled based on emissions rather than type of cargo as in the current rule, and the development of methodology to easily determine applicability of the standards to any given load; 2) a reduction in the fugitive emission standards (measured as a concentration of organic compounds in ppm) based on the current South Coast standard of 1000 ppm; and 3) a requirement to control emissions from ballasting into non-segregated tanks where a regulated cargo was previously stored.

### **Emission Reductions Expected**

A preliminary assessment of the potential reductions estimates that ROG reductions from 0.2 to 0.5 tons per day could be achieved from control of additional cargo and/or control to a more stringent level. In addition, unregulated housekeeping emissions are estimated to be able to be reduced by from 0.5 tons per day or more.

### **Costs of Control**

The technical assessment document estimates costs of control for these additional emissions reductions. The TAD assumes that at least one facility may need to modify its control system and notes that the original costs of control were between \$1,000,000 and \$30,000,000 per terminal, in addition to costs of \$100,000 to \$2,000,000 per ship to retrofit to accommodate vapor recovery equipment. Estimates of the cost to control unregulated cargo is from \$9000 to \$15,000 per load. At 50,000 barrels per load and 6,400,000 barrels loaded yearly of currently unregulated cargo, 90% of which would need control, costs range from \$1,036,800 to \$1,728,000 yearly. Given the emission reduction estimates of 0.22 to 0.5 tons per year, the cost effectiveness for the control of currently unregulated cargo ranges from \$5680 to \$21,600 per ton of ROG reduced.

Control of housekeeping emissions is expected to be cost effective, because tank cleaning done under vapor recovery may speed up the process, resulting in fewer demurrage fees for shipping operators. A demurrage fee is a charge for detaining a ship beyond that necessary for loading or unloading cargo. Based on the costs of technology necessary to control housekeeping emissions, a full analysis of the cost effectiveness of this control suggestion will be part of the rule development effort.

### **Other Impacts**

The marine loading operations are part of existing industrial complexes, both part of and apart from refinery operations. The addition of control equipment and associated piping and hardware is not

expected to result in adverse environmental impacts. However, to the extent that additional control equipment is required, there may be an increase in incineration technology used to abate emissions. Incineration generates NO<sub>x</sub> emissions.

**References**

Technical Assessment Document, Further Study Measure 11, Regulation 8, Rules 44 and 46, Marine Loading Operations, BAAQMD, Dec. 2002

Draft Staff Report, Proposed Revision and Consolidation of Regulation 8, Rule 44 and Rule 46: Marine Loading Operations, BAAQMD, Oct. 2003

## **ORGANIC LIQUID STORAGE TANKS**

***Suggested Measure Reference # 25, 26, 30, 40***

### **Control Measure Description**

This control measure would reduce ROG emissions from organic liquid storage tanks by supplementing existing requirements in Regulation 8, Rule 5: Storage of Organic Liquids.

### **Background and Regulatory History**

Regulation 8, Rule 5: Storage of Organic Liquids, was adopted in 1978. The rule mandates equipment standards for large organic liquid storage tanks. The rule applies to tanks storing liquids with a vapor pressure of at least 0.5 psia. Larger tanks and tanks storing highly volatile liquids are required to meet more stringent standards. This control measure applies primarily to large, floating roof tanks that are typically found at petroleum refineries and chemical plants, and gasoline bulk plants and terminals.

The 2001 Ozone Attainment Plan included two commitments regarding organic liquid storage tanks. Control Measure SS-12 focused on inspection requirements and was implemented through an amendment to Regulation 8, Rule 5 in November 2002. Further Study Measure FS-10 focuses on enhanced control requirements for tanks. A draft technical assessment document (TAD) was released in January 2004. The TAD investigated the feasibility of requiring controls on lower vapor pressure liquids than Reg 8-5 currently requires, retrofitting external floating roof tanks with domes to reduce evaporation from air movement across the tank, imposing more stringent tank cleaning standards, requiring external floating roof tanks to be retrofitted with vapor recovery, a provision to allow minor maintenance and encourage more frequent self-inspections, and phasing out riveted tanks currently in service.

### **Emissions Subject to Control**

Emissions from storage tanks are included in the emissions inventory in Petroleum Refinery Evaporation, Storage Tanks. *Categories 55, 56, 57, and 58* address cone roof tanks, external floating roof tanks, internal floating roof tanks, and other tanks. *Category 940* addresses tank cleaning in petroleum refineries. Fuels Distribution contains the emission inventory categories for gasoline tanks in bulk terminals and bulk plants (*Categories 62 and 63*). Other organic liquid storage tanks are found in *Categories 84 and 85*, which address cone roof tanks and other types of tanks, respectively, in both point and area sources. This control measure focuses on point (permitted) sources.

Emissions are derived from AP-42 correlation equations. The technical assessment document recommends that several elements in the calculations change, because the equations currently in use do not account for evaporative losses through deck fittings and do not account for “zero-gap” seals that are required on many tanks. Potential changes to the calculations are the subject of ongoing discussions with refinery representatives.

<i>Emissions Subject to Control (TPD, Summer)</i>								
	<i>Categories</i>							
	<i>55</i>	<i>56</i>	<i>57</i>	<i>58</i>	<i>940</i>	<i>62 - 63</i>	<i>84</i>	<i>85</i>
<i>2003</i>	2.10	1.31	.08	.05	.05	.56	.78	.15



2006	2.19	1.36	.08	.05	.05	.56	.82	.15
------	------	------	-----	-----	-----	-----	-----	-----

The ROG emissions subject to control total 5.08 tons per day in 2003 and 5.26 tons per day in 2006.

### **Proposed Method of Control**

The draft technical assessment document (TAD) has several recommendations to reduce emissions from organic liquid storage tanks: 1) a requirement for domes to reduce wind speed over floating roof tanks that store liquids with at least 3.0 psia vapor pressure, 2) improved standards for degassing and cleaning tanks and for storing and transporting removed sludges, and 3) implement an inspection and maintenance program that provides an incentive for more frequent tank inspections.

The TAD did not recommend that three items be pursued as controls: 1) lowering the applicability of the rule to lower vapor pressure material, 2) requiring external floating roof tanks to be retrofitted to internal floating roofs or fixed roofs with vapor recovery, and 3) phasing out of riveted tanks.

### **Emission Reductions Expected**

The staff report for South Coast Rule 1178, which requires that domes be retrofit onto floating roof tanks, estimates emission reductions of approximately 46%. The Bay Area may not achieve the same reductions because many Bay Area tanks are subject to more stringent seal requirements than in the South Coast. The emission inventory for tank cleaning is very small, although as tanks are cleaned infrequently, the emissions may be significant on days when tank cleaning occurs. Further work will quantify potential emission reductions from sludge handling. Also, emissions reductions for an inspection and maintenance program have not been determined.

### **Costs of Control**

The cost effectiveness of requiring domes on external floating roof tanks is \$10,917 per ton of ROG emissions reduced, according to the South Coast staff report for Rule 1178; however, as noted above, if the emission reductions are lower, the measure would be more costly in dollars per ton ROG emissions reduced. Cost effectiveness for the remaining recommendations will be determined.

### **Other Impacts**

Refinery and non-refinery tanks exist in industrial areas. Additional requirements related to tank cleaning or maintenance programs are not expected to have any adverse environmental impacts. Organic liquid storage tanks can be large, up to 200 feet in diameter in some cases. Adding domes to these structures may impair some views or visual scenes. Also, the addition of domes would mean that entry to verify compliance would be treated as confined space entry and subject to various additional safety standards. Some inspections now required may not be able to be accomplished.

### **References**

Proposed Rule 1178: Further Reductions of VOC Emissions From Storage Tanks At Petroleum Facilities, Staff Report, South Coast AQMD, December 11, 2001  
Technical Assessment Document, Further Study Measure 10, Organic Liquid Storage Tanks, BAAQMD, January, 2004  
Conversation, Julian Elliot, February 26, 2004

## **PRESSURE RELIEF DEVICES**

***Suggested Measure Reference # 26, 39***

### **Control Measure Description**

This control measure would further reduce ROG emissions from pressure relief devices in petroleum refineries and chemical plants.

### **Background and Regulatory History**

Pressure relief valves (PRVs) or pressure relief devices (PRDs) are safety devices installed in refinery and chemical plant process units on pressure vessels and tanks. They function to release overpressures that could threaten the integrity of the process vessel or tank. These devices are typically vented either directly to atmosphere through a PRV or PRD, or to atmosphere through a blowdown system. Some blowdown systems vent to atmosphere with limited controls, most are vented to a flare.

The District regulates ROG emissions from pressure relief devices via requirements in Regulation 8, Rule 28: Pressure Relief Devices at Petroleum Refineries and Chemical Plants. Reg 8-28 was first adopted in 1980 and significantly amended on December 17, 1997. The amendments require refineries to conduct PRD monitoring, reporting, and release prevention planning. Also, the rule requires controls for new PRDs and for PRDs that have repeat releases. In the 2001 Ozone Attainment Plan for the San Francisco Bay Area, the District committed to study the viability of further controls on PRDs in Further Study Measure 8. A draft technical assessment document was completed in December, 2002. The document recommends several changes to Bay Area Regulation 8, Rule 28 and identifies two strategies to further control emissions from these devices. No comments have been received in response to the technical assessment.

### **Emissions Subject to Control**

Emissions from pressure relief devices are reported in Category 19 in the emissions inventory, *Pressure Relief Valves*. The emissions inventory for this category is derived from the annual updates submitted by the affected industries. The emission inventory since 1980 shows significant differences year to year, because of the episodic nature of the releases. For example, 2000 data shows ROG emissions of 0.6 tons per day. 2002 data, the most recent year for which plant submissions are available, shows ROG emissions of 0.18 tons per day. 2003 and future year emissions are calculated from 2002 data.

<i>Emissions Subject to Control (TPD, Summer)</i>	
<i>Year</i>	<i>Cat. 19 Pressure Relief Valves</i>
2003	0.19
2006	0.19

Regulation 8, Rule 28 also requires that emissions be calculated for releases and submitted to the District. The highest calculated emission release from a single event during the study period used for the technical assessment document was 32,000 pounds (16 tons) organic compounds. This occurred during one day. The lowest calculated emission from a release event in the study was 6 pounds and the median calculated emission was between 3600 and 3700 pounds.

## **Proposed Method of Control**

The technical assessment document for Further Study Measure 8 from the 2001 Ozone Plan suggests further controls on pressure relief devices and recommends several changes to Bay Area Regulation 8, Rule 28: Episodic Releases from Pressure Relief Devices at Petroleum Refineries and Chemical Plants. The standards in Reg 8-28 for existing PRDs that require prevention measures, hazards analyses and controls do not become effective until the first scheduled turnaround for repair or maintenance of the process unit that contains the PRD. The recommendations are: 1) make PRDs subject to the existing Reg 8-28 requirements prior to a turnaround, 2) amend timelines that are the basis of the definition of repeat ventings, 3) require monitoring or indicators so ventings can be verified and emissions quantified, 4) include a leak or emission standard, and 5) implement recommendations from previous rule audits. These measures would make the rule more enforceable and provide more complete information about releases. Also, vapor recovery systems will need to be evaluated to see if potential emissions could be reduced by routing releases through the existing systems. Because one possible way to minimize ventings is to route gases through flares, this effort will be coordinated with current efforts regarding control of emissions from flares.

## **Emission Reductions Expected**

Based on estimates by EPA and others, increased monitoring requirements can be expected to reduce emissions by about 20%. This would result in ROG emissions reductions of 0.037 tons per day. These potential emission reductions do not account for any emissions inventory adjustments based on data reported pursuant to the requirements of Reg 8-28. It should be noted that a 20% reduction in the highest day calculated emissions from the technical assessment would result in emissions of over 0.04 tons per day annualized (16 tons/day / 365 days/year).

The emissions on an annualized basis (tons per day annualized) are not sufficient to suggest a control measure. This control measure is recommended for inclusion in an ozone strategy because of the potential to reduce a large amount of organic emissions during release events. The technical assessment document notes that during the study period, an average of 12 releases per year occurred. ROG Emissions from the emissions inventory calculated for 12 days equal 5.6 tons per day. A reduction of 20% equals 1.1 tons per day.

The technical assessment document also contains reported emissions estimates for 30 releases during the study period, from 8/03/1998 through 10/19/2002. The emissions are only from petroleum refineries. The ROG emissions based for these 30 days total 89.38 tons or 2.98 tons per day. A reduction of 20% would be about 0.6 tons per day.

## **Costs of Control**

To be determined.

## **Other Impacts**

Any rule development effort directed at pressure relief devices needs to recognize that the purpose of these devices is safety. PRVs and PRDs prevent overpressurization of vessels to avoid fires or explosions. As long as safety considerations are not compromised, significant adverse environmental impacts are not expected as a result of either adding to the existing rule or requiring more control of emissions from these devices. When these devices release, there is the potential for a large amount of toxic compounds to be released in fairly close proximity to communities. Consequently, there may be a large reduction in potential exposure to those compounds from implementation of this control measure. The affected systems are part of existing refinery operations, so that additional equipment added to these systems will not cause additional impacts.

However, to the extent that additional control equipment is required, there may be an increase in incineration technology used to abate emissions. Incineration generates NO<sub>x</sub> emissions.

**References**

Technical Assessment Document, Further Study Measure 8, Pressure Relief Devices, BAAQMD, Dec. 2002

## STATIONARY GAS TURBINES

**Suggested Measure Reference # 50, 54, 56**

### Background

This control measure would reduce emissions of nitrogen oxides (NO<sub>x</sub>) from stationary gas turbines through the revision of existing limits to reflect current best available retrofit control technology (BARCT).

### Regulatory History

The District regulates NO<sub>x</sub> emissions from stationary gas turbines under Regulation 9, Rule 9. The rule was adopted in 1993 pursuant to California Air Resources Board (CARB) pollution transport regulations (California Code of Regulations beginning at section 70600). The CARB regulations required the BAAQMD to adopt by 1994 best available retrofit control technology (BARCT) for source categories that collectively amounted to 75% of the 1987 nitrogen oxides emission inventory. The BAAQMD standards for existing turbines are 9 to 42 ppm depending upon turbine size, with small turbines subject to less stringent limits.

The CARB transport regulations were amended in 2003 and now require adoption of “all feasible measures” to reduce ozone precursor emissions.

In 2002, the San Joaquin Valley Unified APCD adopted amendments to its gas turbine rule (Rule 4703) that impose turbine NO<sub>x</sub> standards more stringent than the standards found in the rules of most other air districts. The most significant of the SJVUAPCD amendments require larger turbines (greater than 10 megawatts) to meet standards of either 3 or 5 ppm, depending upon the installation date of NO<sub>x</sub> controls.

### Emissions Subject to Control

Turbine emissions are included in the BAAQMD inventory in the category called *fuels combustion – turbines*. Estimated emissions for the category are set forth below.

<i>Emissions Subject to</i>	
<u>Year</u>	<u>Control (TPD, Summer)</u>
2003	1.77
2006	1.83

### Proposed Method of Control

Most emission reductions would come from the installation of selective catalytic reduction (SCR) on large turbines (>10 MW) that do not currently use SCR to control NO<sub>x</sub> emissions.

There are approximately 50 stationary turbines operating in the BAAQMD. Five of the turbines already meet 5 ppm limits, and the measure would not reduce emissions for those turbines. Another 10 large turbines currently meet 9 ppm limits using SCR. Emission reductions from requiring these turbines to meet a 5 ppm limit are likely to be minor, and cost effectiveness for controls is likely to be poor unless the limit can be achieved through catalyst resizing. Eight large turbines are currently subject to a 15 ppm limit, and adoption of the SJVUAPCD limits would require that they meet a 5

ppm limit. These turbines are all larger than 10 MW and do not use SCR for NO<sub>x</sub> control. Installation of SCR may not be feasible for all 8 turbines because of site-specific constraints.

Some very minor emission reductions might come from the installation of dry low-NO<sub>x</sub> combustors (DLN) on small turbines (<10 MW) currently subject to 42 ppm limits. The San Joaquin limits are 35 ppm limit if DLN is not available and 25 ppm if DLN is available. DLN appears to be available for less than half of the 13 Bay Area turbines in this size range. Emission reductions would be minor.

### **Emission Reductions Expected**

Requiring turbines larger than 10 MW to meet a 5 ppm standard would reduce emissions by approximately 1.2 tons per day, assuming SCR installation is feasible and cost effective for all turbines in this category. Additional minor emission reductions may be achievable for some smaller turbines through the installation of DLN. Greater precision in the emission reduction estimate cannot be achieved without detailed investigation for each turbine.

### **Costs of Control**

The SJVUAPCD found that cost effectiveness for the installation of SCR on turbines larger than 10 MW ranged from approximately \$5,000 per ton to approximately \$10,000 per ton. Cost effectiveness for the installation of DLN on smaller turbines was in this same range.

### **Other Impacts**

Bay Area NO<sub>x</sub> reductions may reduce ambient levels of particulate pollution, because some fraction of the NO<sub>x</sub> emissions is ultimately converted to nitrate particles in the atmosphere. However, these reactions are not currently well understood and are difficult to quantify.

Minor adverse environmental impacts may occur as a result of this control measure. Photochemical modeling from the 1980's and 1990's and recent ambient measurements indicate that Bay Area NO<sub>x</sub> reductions are likely to cause localized increases in Bay Area ozone levels. In addition, ambient measurements suggest an emerging "ozone weekend effect" in the Sacramento area that may mean Bay Area NO<sub>x</sub> reductions are counterproductive in reducing downwind ozone. Further information on the benefits and disbenefits of Bay Area NO<sub>x</sub> reductions may come from photochemical modeling associated with the Central California Ozone Study.

Additional use of SCR would increase ammonia emissions and the hazards associated with the transportation and use of ammonia, since the SCR system relies on ammonia injection to reduce NO<sub>x</sub>.

### **References**

- Blanchard, C., Tanenbaum, S. "Characterization of CCOS Intensive Operating Periods: Task 4c. Supplemental Analyses: Corroborative Analysis" (paper prepared by Envair for the Central Coast Ozone Study/ARB, 2001)
- Gallenstein, C., California Air Resources Board. 2003. Personal communication.
- Marr, L.C., Harley, R.A. 2002. "Spectral analysis of weekday-weekend differences in ambient ozone, nitrogen oxide, and non-methane hydrocarbon time series in California." *Atmospheric Environment* 36, 2327-2335.
- San Joaquin Valley Unified APCD. 2002. "Final Staff Report: Amendments to Rule 4703 (Stationary Gas Turbines)" and Appendices.
- U.S. Environmental Protection Agency. 2000. "Compilation of Emission Factors, AP-42, 5th Ed., Chapter 3.1: Stationary Gas Turbines, Supplement F" and supporting materials including

Background Document and turbine database.

## **WASTEWATER SYSTEMS**

***Suggested Measure Reference # 24, 25, 26, 43***

### **Control Measure Description**

This control measure would reduce ROG emissions from refinery wastewater systems by requiring control, covers or water traps at various emission points such as open drains, sumps, junction boxes and manholes.

### **Background and Regulatory History**

The District regulates ROG emissions from wastewater systems by setting equipment standards which require minimum gaps in seals around oil-water separators, gauging and sampling wells, dissolved air flotation units, slop oil vessels, separator effluent channels and junction boxes. The rule has emission limits measured in parts per million concentration as an option in lieu of these standards for large oil-water separators and requires vapor recovery with efficiency standards (percent control efficiency) for sludge de-watering units. The rule also allows vapor recovery with efficiency standards as an option for oil-water separators, slop oil vessels and dissolved air flotation units. Regulation 8, Rule 8 was first adopted in 1979, significantly amended in 1989 and amended to address EPA policy issues in 1993 and 1994.

### **Emissions Subject to Control**

In December, 2002, the staff of the California Air Resources Board and District produced a technical assessment document (TAD) that characterized the emissions from refinery wastewater systems. Emissions as shown in the District's emission inventory are reported as point sources. Categories exist for refinery oil-water separators (*Category 11*) which includes fugitive emissions from process drains, and refinery wastewater treatment (*Category 12*) which includes the biological and/or chemical treatment, settling and clarification to meet water discharge standards that occurs after the oil-water separator. The emissions inventory is shown below

<i>Emissions Subject to Control (TPD, Summer)</i>		
<i>Year</i>	<i>Cat. 11 separators</i>	<i>Cat. 12 treatment</i>
2003	3.63	0.13
2006	3.80	0.14

Category 11 consists of oil-water separators and process drains, as well as some other sources such as dissolved air flotation units. Process drains constitute most of the emissions, 2.43 tons/day in 2003 and 2.55 tons in 2006. The TAD estimated emissions by a combination of wastewater sampling to determine organic content, and industry and EPA emissions models to calculate emissions from refinery wastewater drains, junction boxes and manholes. The emissions from these models are estimated to be 3.31 tons/day from the combination of these emission points. This increase will be incorporated into the District emission inventory.

### **Proposed Method of Control**

A variety of methods can provide controls for open process drains, junction boxes and manholes, such as installation of vapor recovery on emission points accompanied by a control device, seals or traps on drains and open points in junction boxes and manhole covers, and the installation of solid



pipings where openings to the atmosphere exist. The most cost effective option is to require the installation of water seals on these emission points and to promulgate an emission standard to verify their effectiveness along with a program to assure that the water seals are maintained. The national New Source Performance Standard for refinery wastewater systems requires that emissions from drains meet a 500 ppm hydrocarbon concentration standard. An option not to install water seals could be added as long as emissions from drains do not exceed the ppm standard.

### **Emission Reductions Expected**

Based on established emission reduction factors for water seals, emissions from drains, junction boxes and manholes could be reduced by 65%. Based on the emissions in the inventory, a reduction of 65% would reduce emissions by 1.6 tons per day. Based on the TAD estimates, the emission reduction that could be achieved is 1.8 tons per day, accounting for drains already controlled. The emission estimates do not account for the fraction of diesel oil in the wastewater. This could increase the estimates of emissions, and would also increase the estimates of emissions reductions.

### **Costs of Control**

Staff estimated costs for controls on drains, junction boxes and manholes. The cost of controlling drains is from \$1100 to \$3000 per ton reduced, the cost for junction boxes is from \$3300 to \$4400 per ton reduced, and the cost for manhole covers is from \$3100 - \$8800 per ton reduced. The overall cost effectiveness for this proposed measure is from \$1900 to \$4200 per ton emissions reduced.

### **Other Impacts**

No significant adverse environmental impacts are expected as a result of the adoption of this control measure. The affected wastewater systems are part of existing refinery operations, so that additional equipment added to these systems will not cause additional impacts. The proposed control option will not add to other atmospheric pollutants because additional incineration or adsorption of hydrocarbon vapors is not anticipated. In addition, the existing water treatment systems are designed to handle much greater influent than exists in normal flows. Consequently, additional hydrocarbons going into the treatment system will not result in exceedances of the refineries water discharge permits.

### **References**

Draft Technical Assessment Document: Potential Control Strategies to Reduce Emissions from Refinery Wastewater Collection and Treatment Systems, CARB, and BAAQMD, Jan. 2003  
SJVUAPCD Rule 4625: Wastewater Separators  
South Coast AQMD Rule 1176: VOC Emissions from Wastewater Systems

## **WOOD PRODUCTS COATING**

***Suggested Measure Reference # 44, 45***

### **Control Measure Description**

This control measure would reduce ROG emissions from wood coating facilities by lowering some VOC limits in Regulation 8, Rule 32: Wood Products Coating.

### **Background and Regulatory History**

The District regulates ROG emissions from wood coating facilities by setting volatile organic compound (VOC) limits on various types of coatings used on wood, clear and pigmented topcoats, sanding sealers, penetrating sealers (wash coats), fillers and stains. Also, the rule requires the use of spray technology that is transfer efficient to minimize that the amount of paint that misses or bounces off the intended surface.

Rule 32 regulates coatings used in the manufacturing of furniture, kitchen cabinets, outdoor speakers, picture frames, bathroom vanities and other wood products. Rule 32 was adopted in 1983 and amended several times. The most significant amendments were in 1991 and 1995. The rule exempts certain types of products and operations for which low VOC technology is not appropriate, such as musical instruments, antique refinishing and foundry patterns. Emissions from wood product coating have been reduced by 50% through the implementation of VOC limits in the rule. A reduction in the number of facilities operating in the Bay Area has also reduced emissions from this source category.

### **Emissions Subject to Control**

The emissions from wood coating operations are included in the emission inventory as point sources. Any coating operation that uses 30 gallons of coating and solvent per year is required to have a District operating permit, and must submit usage information annually from which emissions are calculated. Wood product coating emissions are found in *Category 256* in the emissions inventory. *Category 257* is surface preparation and clean up solvents used in wood finishing operations.

<i>Emissions Subject to Control (TPD, Summer)</i>		
<i>Year</i>	<i>Cat. 256</i>	<i>Cat. 257</i>
2003	2.74	0.44
2006	2.78	0.46

### **Proposed Method of Control**

Several other California districts have adopted VOC limits that are more stringent than the Bay Area's. Generally, the difference between rules is marginal currently, but the other rules become more stringent in July, 2005. The following table illustrates the major differences in the rules in four districts, expressed in allowable VOC content in grams/liter.

Coating	Bay Area current	South Coast <sup>(2)</sup> effective 7/05	Sacramento <sup>(2)</sup> effective 7/05	San Joaquin <sup>(2)</sup> effective 7/05
---------	---------------------	--	---	--

**PRELIMINARY DRAFT Control Measure Descriptions**

Clear topcoat	275/550 <sup>(1)</sup>	275	275/550 <sup>(2)</sup>	275
Sanding sealer	550	275	275	275
Color topcoat	275/550 <sup>(1)</sup>	275	275	275
High solid stain	700	350	350	240
Low solid stain	480	120	120	120
Filler	500	275	275	275
Wash coat	480	120	120	120

Notes:

(1) The lower limits are for general wood products, the higher are for furniture.

(2) Other coating limits apply.

(3) The higher limit is for conversion varnish, a type of clear or colored topcoat.

The current Bay Area limits in Rule 32 are higher than the future limits in the other rules, 550 g/l for clear and colored topcoats and sealers, except for the Sacramento limit for conversion varnish, 700 g/l for high solids stains, and 480 g/l for low solids stains and washcoats. Based on the other districts adopted future limits, the following VOC limits are suggested for consideration, at a minimum:

High solids stain	350 g/l
Sealers	275 g/l
Filler	275 g/l
Low solids stains	120 g/l
Wash coats	120 g/l

**Emission Reductions Expected**

A 1998 study conducted by UC Davis under ARB contract 93-343 that accompanies the control measure found that high solids stains were 15% of the volume of coatings used, sealers were 23%, fillers were 3% and low solids stains and washcoats were 6%. The following table illustrates potential emission reductions from the above suggested limits, assuming that the volume percentage coating used is equivalent to a percentage of emissions and that there was no reduction in volumes used due to a higher solids content of lower VOC materials.

## ***PRELIMINARY DRAFT Control Measure Descriptions***

<u>Coating</u>	<b>Current VOC (g/l)</b>	<b>Suggested VOC (g/l)</b>	<u>Calculation</u>	<b>Reduction tons/day</b>
High solid stain	700	350	$2.74 \times 0.15 \times (700 - 350) / 700$	0.21 t/dy
Sealers	550	275	$2.74 \times 0.23 \times (550 - 275) / 550$	0.31 t/dy
Fillers	500	275	$2.74 \times 0.03 \times (500 - 275) / 500$	0.04 t/dy
Low solid stain	480	120	$2.74 \times 0.06 \times (480 - 120) / 480$	0.12 t/dy
Wash coat	480	120	Included with low solid stains	

Together, the potential emission reduction is 0.68 tons per day. This does not include potential reductions from clear topcoats, which represent 48% of the volume of coating used. Because of the potential based on volume, and the lower limits in other rules, lower VOC limits should be investigated.

### **Costs of Control**

In the staff report for the proposed amendments to South Coast Rule 1136, the cost effectiveness was estimated to range from \$1900 to \$2900 per ton for waterborne systems, and for acetone reformulated coatings to be slightly less, about \$1600 per ton. At an inflation rate of 3%, this equates to a range of \$2406 per ton to \$3674 for waterborne coatings and \$2026 per ton for acetone coatings. This is within the range of cost effectiveness of other surface coating control measures.

### **Other Impacts**

During the course of rule development in 1990 and 1995 for Bay Area Regulation 8, Rule 32: Wood Products Coating, it was found that the Bay Area is home to a unique set of custom furniture and millwork manufacturers and antique refinishers, for which coatings designed for large factory environment applications would not be able to be employed. Consequently, coating technology that meets the requirements of wood product manufacturers in other districts may not be applicable to the Bay Area.

When the South Coast rule requirements came into effect, they found an increase in the use of an ozone depleting compound, 1,1,1 trichloroethane, of about 1 ton per day. Since that time, however, the Montreal Protocol and 1990 Clean Air Act amendments have phased out the production of this compound. The Bay Area rule does not exempt ozone depleting or toxic compounds, so proposed rule limits must be reviewed in this light. In addition, most districts have VOC limits on strippers. Most commercial furniture refinishers use methylene chloride for wood stripping, which is exempt in the other rules. Methylene chloride, pursuant to the Bay Area policy of not exempting ozone depleting or toxic substances is considered a VOC. A reduction in the VOC content for strippers in the Bay Area may be technically infeasible, however controls may be required for strippers through either the Bay Area risk reduction program or through the development of a statewide Air Toxic Control Measure.

### **References**

Industrial Surface Coatings-Wood Furniture & Fixtures Emission Inventory Development, Robert P. Anex, et al, U.C. Davis Civil Engineering Department, June 1998, Air Resources Board Contract 93-343

Staff report, Proposed Amendments to Rule 1136 - Wood Products Coating, South Coast AQMD, May 10, 1996

**Bay Area 2004 Ozone Attainment Strategy**  
**Preliminary Draft Control Measure Descriptions**  
**March 16, 2004**

Introduction

Air District and MTC staff have been evaluating potential control measures for inclusion in the Bay Area 2004 Ozone Strategy. The Air District has evaluated control measures for stationary, mobile and miscellaneous other sources. MTC has taken the lead on evaluating transportation control measures, in consultation with Air District staff.

Staff have presented the evaluations for public review at two meetings of the Ozone Working Group and have made them available on the Air District website. Based on discussions at the OWG, written comments, and further analysis, staff have begun developing draft control measures for inclusion the Draft Ozone Strategy. The attached materials present preliminary draft control measure descriptions. These draft control measure descriptions are still undergoing analysis and review, and thus are preliminary.

Work to date

The Air District control measure evaluations identified 57 potentially viable measures for stationary, mobile and miscellaneous sources. Staff is developing draft control measure descriptions for the potentially viable measures. In most cases, a draft control measure description includes proposals or concepts from more than one suggestion in the evaluation tables, because several suggestions may address the same source category or propose closely related control strategies. Thus, the number of draft control measures is less than the number of suggestions on the evaluations.

Stationary source measures will be implemented through revisions to Air District regulations. Mobile source measures will be implemented through incentive programs and public education programs. Miscellaneous measures will be implemented through public education programs and transportation programs. Preliminary draft control measure descriptions have been completed for the following stationary and mobile source control measures:

- Auto Refinishing
- Boilers Rated Between 5 and 10 MMBTU/HR
- Flares
- High Emitting Spray Booths
- Large Water Heaters and Small Boilers
- Low Emission Vehicles
- Marine Loading Operations
- Organic Liquid Storage Tanks
- Pressure Relief Devices
- Stationary Gas Turbines
- Wastewater Systems
- Wood Products Coating

Work is proceeding on developing control measure descriptions for the remaining stationary and mobile source measures:

- Gasoline Bulk Terminals and Bulk Plants
- Graphic Arts Operations
- Green Contracting Ordinance

- 
- Polystyrene Resin Operations
  - Truck Idling Ordinance

MTC has evaluated enhancements to transportation control measures covering a wide range of travel behavior and systems management concepts. Based on the evaluations and public input, MTC staff, in consultation with District staff, have prepared draft TCM descriptions. The TCMs address State ozone planning requirements for the Bay Area. TCMs adopted by MTC for federal air quality planning will be identified separately in the Ozone Strategy, in the section addressing national ozone planning requirements. TCMs will be implemented through State, regional and local funding processes, incentive programs, outreach and public education, and other programs. Preliminary draft descriptions have been completed for the following TCMs:

TCM 1Support Voluntary Employer Based Trip Reduction Programs

TCM 3Improve Local and Areawide Bus Service

TCM 5Improve Access to Rail and Ferries

TCM 7Improve Ferry Service

TCM 8Construct Carpool/Express Bus Lanes on Freeways

TCM 9Improve Bicycle Access and Facilities

TCM 12Arterial Management Measures

TCM 13Transit Use Incentives

TCM 15Local Land Use Planning and Development Strategies

TCM 18Transportation Pricing Reform

TCM 19Improve Bicycle Access and Facilities

TCM 20Promote Traffic Calming

Work is proceeding on developing draft descriptions for the remaining seven TCMs:

TCM 4Improve Regional Rail Service

TCM 6Improve Interregional Rail Service

TCM 10Youth Transportation

TCM 11Install Freeway/Arterial Metro Traffic Operation System

TCM 14Improve Rideshare/Vanpool Services and Incentives

TCM 16Intermittent Control Measures/Public Education

TCM 17Conduct Demonstration Projects

#### Next Steps

Air District and MTC staff invite public discussion and input on the preliminary draft control measure descriptions. Staff will consider public input, and conduct further analysis where necessary, in order to develop proposed control measures for inclusion in the Draft 2004 Ozone Strategy. Staff also will continue to develop draft control measure descriptions for the remaining potentially viable measures and TCMs, including contingency and other measures required for future federal air quality plans, as necessary. The remaining draft control measure descriptions will be released for public review, no later than the May meeting of the Ozone Working Group.

**DRAFT**  
**BAY AREA**  
**2004 OZONE STRATEGY**

**Preliminary**  
**Transportation Control Measure**  
**Descriptions**



---

**Prepared by  
Bay Area Air Quality Management  
District in cooperation with  
Metropolitan Transportation Commission  
and  
Association of Bay Area Governments**

---



---

## TABLE OF CONTENTS

TCM 1	Support Voluntary Employer Based Trip Reduction Programs.....	E-2
TCM 2	Adopt Employer Based Trip Reduction Rule (DELETED).....	E-4
TCM 3	Improve Local and Areawide Bus Service (includes Clean Fuel Buses).....	E-6
TCM 4	Improve Regional Rail Service .....	E-8
TCM 5	Improve Access to Rail & Ferries.....	E-10
TCM 6	Improve Interregional Rail Service.....	E-12
TCM 7	Improve Ferry Service.....	E-14
TCM 8	Construct Carpool/ Express Bus Lanes on Freeways.....	E-15
TCM 9	Improve Bicycle Access and Facilities.....	E-18
TCM 10	Youth Transportation (includes Clean Fuel School Buses).....	E-20
TCM 11	Install Freeway / Arterial Metro Traffic Operations System (MTOS) .....	E-22
TCM 12	Arterial Management Measures .....	E-23
TCM 13	Transit Use Incentives .....	E-25
TCM 14	Improve Rideshare/ Vanpool Services and Incentives .....	E-28
TCM 15	Local Land Use Planning and Development Strategies.....	E-30
TCM 16	Intermittent Control Measure / Public Education .....	E-33
TCM 17	Conduct Demonstration Projects (includes Clean Air Vehicles).....	E-35
TCM 18	Transportation Pricing Reform.....	E-37
TCM 19	Improve Pedestrian Access and Facilities.....	E-41
TCM 20	Promote Traffic Calming .....	E-43

The transportation control measures (TCMs) in this appendix for the 2004 Ozone Strategy were designed to reduce emissions from motor vehicles by reducing vehicle trips and vehicle miles traveled. TCMs may also reduce vehicle use, vehicle idling or traffic congestion. These TCMs address State ozone planning requirements for the Bay Area. TCMs adopted by MTC for federal air quality planning are identified elsewhere in the Ozone Strategy, in the section addressing national ozone planning requirements. Some of the TCMs are included in local, regional and state transportation programs. We expect to see those measures implemented, and achieve the emissions reductions we have projected. Other measures have little or no funding, and may require legislative authorization and voter approval prior to implementation. One example is TCM 18, Transportation Pricing Reform. While the Air District would also like to see the most effective TCMs implemented, we acknowledge that there are significant obstacles that first must be overcome. Public education efforts must be undertaken in order to gain acceptance of these often-controversial measures.

---

## **TCM 1 - SUPPORT VOLUNTARY EMPLOYER-BASED TRIP REDUCTION PROGRAMS**

### **Purpose**

TCM 1 will support and encourage voluntary efforts by Bay Area employers to promote the use of commute alternatives by their employees.

### **Background**

The political and economic climate for employer-based trip reduction has changed since the early 1990's, when employer-based trip reduction programs received greater emphasis in Bay Area air quality plans. Major developments include 1) the enactment of SB 437, which prohibited mandatory employer trip reduction programs as of January 1, 1996, and 2) the reduction in public sector funding for transportation demand management programs.

Despite these developments, the need for trip reduction programs remains strong. As the Bay Area economy recovers from the current recession, employment will grow, which means that peak period congestion on Bay Area freeways and local roads will increase. Increased traffic volumes in general will increase motor vehicle emissions, and congestion in particular increases auto emissions due to stop and go traffic and lower average speeds. Employment growth in the Bay Area has been especially robust in suburban areas, which due to land use patterns and limited transit infrastructure, tend to have the highest drive alone rates. In the near term, carpool and vanpool programs are especially suited for many suburban locations.

Commute trips, which comprise 25% of daily trips, are still logical targets for employer-based trip reduction efforts due to: a) their key role in contributing to peak period traffic congestion and ozone formation, b) the long average distance of commute trips compared to other trip types, c) the repetitive nature of commute trips that occur on the same route and schedule each day, d) the pool of potential candidates for ridesharing at larger work sites, and e) the ability of employers to influence employee commute mode choice by means of the facilities, services, and incentives that they provide.

While the need for employer programs is undiminished, TCM 1 will focus on assessing employer needs and maintaining core support services to employers. Generally, most of this effort will be accomplished through the regional ridesharing program administered by MTC and through discussions between the Air District and employers involved in the Spare the Air program, the Bay Area Clean Air Partnership (BayCAP), and other outreach efforts.

### **Description**

TCM 1 includes the following:

Phase 1 (2004-2006). Generally maintain current efforts:

- Provide core support for employer programs, based on an assessment of employer needs and the level of employer interest. Potential support includes assistance in developing or enhancing employer programs, information and referrals, employer networks, and programs to recognize outstanding employer programs.
- Support legislation to maintain and expand incentives for employer programs, such as tax deductions and/or tax credits for employer efforts to promote ridesharing, transit, and other commute alternatives. (MTC, Air District, Congestion Management Agencies.)
- Implement employer elements of the *Spare the Air* program (see TCM 16).
- Provide information and assistance to employers in organizing transportation fairs and other marketing events at Bay Area work sites.

- 
- Work with employers to implement regional promotions such as Rideshare Week, Bike to Work Day, etc.
  - Work with employers to implement provisions of the State parking cash-out law, where certain employers who lease parking and provide subsidized parking to employees must offer their employees the choice of the subsidized parking or the equivalent value of the parking space as a cash payment to use for commute alternatives such as carpooling, transit, bicycling and walking, or to retain as additional income (see TCM 18).
  - Promote **Commuter Check** transit subsidy program to employers (see TCM 13).
  - Implement sub-regional or local programs to promote employer-based trip reduction in those cities and counties that choose to allocate local resources to such efforts. (Congestion Management Agencies, county transportation authorities, cities and counties).
  - Work with cities, counties and other public agencies who are also employers to develop commute alternatives, including telecommuting, compressed work week schedules, guaranteed ride home programs, etc. (MTC and the Air District can make special efforts to work with governmental agencies to encourage their support for these types of programs and explore new funding opportunities).

#### Phase 2 (Beyond 2006)

- Continue programs listed above.
- Seek legislation to create incentives for stronger voluntary programs for all employers or to require certain minimum elements of a basic commute alternatives program for public employers.

### Travel Market Affected

This TCM targets commute travel, which accounts for approximately 25% of trips and 33% of VMT on a typical weekday.

### Effectiveness

Due to existing legislation and the voluntary nature of this measure, no new emissions reductions are assumed. However, without maintaining current efforts, drive alone commute trips and emissions would likely increase.

Empirical results show that employer trip reduction programs can decrease vehicle trips to a typical worksite by as much as 5-10 percent. Results from a 1996 BayCAP survey showed that work sites with voluntary trip reduction programs reduced commute trips by about 8 percent compared to the average for large work sites in 1994-95 before implementation of mandatory employer-based trip reduction.

### Cost

The costs of this TCM include the public sector costs to provide services to promote voluntary employer efforts as well as the costs to employers that choose to implement such programs. Much of the public sector costs are included in the cost of funding the regional rideshare program (see TCM 14).

Employer costs depend upon the number of employers that implement voluntary programs and the specific services and incentives that they offer to their employees. Data from studies of mandatory trip reduction programs indicate that employer costs typically ranged from \$25 to \$100 per employee per year. It is expected that employer costs for voluntary programs are lower, perhaps a maximum of \$40-\$50 per employee per year on average. Employer costs are offset to

---

some extent by indirect gains such as increased productivity of employees due to less stressful commutes and improved recruitment and employee retention.

### **Impediments**

The primary impediment is the reduced employer interest in trip reduction efforts given the cost of implementing these types of programs in a weakened economy and the lack of authority for the Air District to require these programs.

### **Other Impacts**

In addition to reducing emissions, this TCM reduces auto trips in congested corridors and reduces fuel consumption and greenhouse gas emissions (CO<sub>2</sub>). Employees will benefit from reduced commute costs, such as vehicle operating and maintenance costs.

## **TCM 3 - IMPROVE LOCAL AND AREAWIDE BUS SERVICE**

### **Purpose**

This TCM will help to reduce motor vehicle trips, vehicle miles traveled, and mobile source emissions by maintaining and improving the Bay Area's extensive bus system, and by funding replacement of diesel buses with clean fuel buses.

### **Background**

TCM 3 will increase the attractiveness of local and regional bus service by ensuring the system is well maintained, adding more service as revenues permit, and developing new service concepts (such as enhanced bus, Rapid Bus Transit and Regional Express buses) to better serve existing markets and fill in regional transit gaps. There are 26 transit operators in the Bay Area that provide local and regional bus service. Each operator must tailor its service to local conditions. Cumulatively, these operators provided over 95 million revenue miles of bus service in FY 2001-2002. Fixed route bus service accounts for approximately 66% of all transit riders in the Bay Area. Certain elements of this TCM – e.g., express bus, enhanced bus, clean fuel buses – will reduce motor vehicle emissions; elements regarding maintenance of the current system seek to assure that existing emission benefits continue.

MTC's long range *Regional Transportation Plan (RTP)* dedicates significant funding to maintaining existing bus facilities and vehicles, but capital and operating shortfalls will still remain to meet future needs. Also, transit operators will be hard pressed to expand service without new revenues. Recent financial conditions have caused many operators to curtail service and/or raise fares. Therefore, the RTP does not anticipate significant improvements to local bus routes at this time, other than some of the improvements discussed below.

Two examples of recent service improvements which would be continued and expanded under this TCM are the enhanced bus/BRT concepts being developed by AC Transit, Muni, and Santa Clara VTA and the Regional Express Bus Program funded with State transportation dollars.

The Air District funds replacement of diesel buses with clean fuel buses through the Transportation Fund for Clean Air. Clean fuel buses meet specified emission standards and do not use diesel as their primary fuel. The Air District also funds retrofits of diesel buses to reduce emissions from existing diesel bus engines.

### **Description**

Improvements in local bus service are determined by the individual transit operator boards, based on revenues available. Decisions on expanding local service must address both the needs of

---

commuters as well as low income travelers who do not have access to a car. MTC has defined a Lifeline Transit Network which addresses some of these needs.

The Regional Express Bus program was funded with \$40 million in State transportation funds which were used to purchase about 90 buses serving 12 new regional express bus routes. Participating transit operators included: AC Transit, CCCTA, Fairfield/Suisun, Golden Gate Transit, LAVTA, Samtrans, Tri-Delta, Vallejo, and West Cat. These buses serve generally longer distance routes that fill in key transit gaps, and use freeway HOV lanes where possible to improve travel times and service reliability.

Several transit operators are considering or have implemented enhanced bus service on major arterials, most notably AC Transit's Route 72 along San Pablo Avenue. Enhanced bus service is a concept that includes more frequent service, relocated bus stops and signal priority treatment for better schedule adherence, real time bus arrival information, improved signage and other passenger amenities. San Francisco Muni has also developed a long range Vision Plan which would provide similar types of services along certain Muni routes. Bus Rapid Transit (BRT) includes most of the features of enhanced bus, and involves even more ambitious enhancements to bus service and would typically include dedicated lanes for bus operations as well.

#### **Phase 1 (2004-2006)**

- Continue to fund the timely replacement of worn out buses in local transit operator bus fleets; while providing flexibility to some operators to use federal funds for preventive maintenance (operating expenses) on a case by case basis.
- Sustain the existing Regional Express Bus Program (12 routes); possible expansion with RM 2 revenues
- Assist transit operators with further planning work on enhanced bus and Bus Rapid Transit concepts
- Continue to seek new funding for MTC's Lifeline Transit Network, to serve low income communities and assist persons transitioning from Welfare to Work (12 new services were recently funded by MTC using federal, state, and local funds).
- Complete retrofitting of 1,700 public transit buses with particulate traps and NOx catalysts. Continue Air District programs to fund the replacement of diesel buses with clean fuel buses and retrofitting of existing diesel buses with diesel emission control technology.
- Sustain current bus services to the three Bay Area commercial airports for air passengers and employees.

#### **Phase 2 (Beyond 2006)**

- Restoration of some local routes that were eliminated or where service was curtailed during the current economic recession
- Additional lifeline service as new funds become available
- Implementation of new Enhanced Bus and Bus Rapid Transit services consistent with the financial assumptions in MTC's long range Regional Transportation Plan
- Expansion of Regional Express Bus Programs in North and South Bay as defined in Regional Measure 2

#### **Travel Market Affected**

---

This measure would affect all intraregional travel, including commute travel, shopping, personal business, social and recreational travel, passenger and commute trips to airports, and school trips.

### **Effectiveness**

Emission reduction estimates for 2006 include the following elements:

- 1) Regional Express Bus Program
- 2) AC Transit Route 72 Enhanced Bus
- 3) MTC program to fund catalytic converters for NO<sub>x</sub> on 1,700 public buses (2005-use Harold's latest calculation). The calculation would also include funding for clean fuel buses through the Air District's Transportation Fund for Clean Air – [Air District provide data]

These programs are expected to yield the following emissions reductions:

<u>ROG</u>	<u>NO<sub>x</sub></u>
TBD	TBD

Emission reductions for 2015 [or other year TBD], the calculation would be based on:

- 1) Modest expansion of the Regional Express Bus program
- 2) AC Transit and Muni Routes likely to be included in the Transportation 2030 Plan

### **Cost**

The cost of restoring and expanding local bus service cannot be estimated at this time. Capital and operating costs for the existing Regional Express Bus Program and various the AC Transit, Muni and VTA enhanced bus and Bus Rapid Transit programs are shown below (to be supplied later):

- Regional Express Buses
- AC Transit Enhanced Bus
- AC Transit BRT
- Muni Enhanced Bus
- Muni BRT
- MTC Lifeline Service (from Transportation 2030)

### **Impediments**

According to MTC's latest financial estimates, the six largest operators of bus service will have combined funding shortfalls of \$1.4 billion in operating and \$740 million in capital replacement over the next 25 years (some of these transit operators also operate rail service as well). Thus restoring service that has been cut and expanding service will require new funding. New

---

revenues may be available in the future from higher gas taxes, bridge tolls, and voter approved sales tax revenues in individual counties.

### **Other Impacts**

An improved bus system will offer more mobility choices for Bay Area travelers, provide a better transit network for those without a car, and reduce vehicle use. The Lifeline Transit Network improves mobility options for low income households. Reductions in vehicle travel will have corollary benefits in terms of saving energy, reducing greenhouse gases, and improving water quality through reduced runoff of oil laden water from roads.

## **TCM 5 - IMPROVE ACCESS TO RAIL AND FERRIES**

### **Purpose**

TCM 5 will reduce motor vehicle trips, vehicle miles traveled and mobile source emissions by reducing auto trips used to make short access trips to rail stations and ferry terminals and by increasing transit ridership by improving access to transit. This measure will expand feeder buses and shuttles, and improve bicycle and pedestrian access. By improving rail and ferry access options, these systems will become more convenient and there is a greater likelihood people will choose transit for their overall trip instead of a car. This measure will complement TCMs 3, 4, 6 and 7.

### **Background**

The Bay Area's extensive investment in rail and will be maximized if there is convenient access to the stations and terminals. Often access is constrained because of limited parking and because transit service to stations may be infrequent or not serve nearby destinations. Walking and bike access may be unsafe or difficult due to local traffic conditions, inadequate bicycle parking, terrain or other obstacles. The same issues apply to existing and potential new ferry terminals that would be developed by the Water Transit Authority in the future.

From the standpoint of air quality, short station access trips by autos present particular problems and opportunities. Motor vehicle emissions are much higher when a cold engine has just been started ("cold start emissions"). Therefore, much of the air quality benefit of transit is negated if riders drive to the station. On the other hand, since most users of transit generally live within a few miles of the transit service, there is considerable potential for alternative access options other than by car. Feeder bus and shuttles, walking, and biking are the principal options. Extensive feeder bus service already exists to many rail stations, so the opportunities for further improvement may be limited, and new service can be expensive. Walking and biking improvements have been a recent focus of public attention, including the Safe Routes to Transit concept. Currently only about 1% of BART's riders bikes to BART. In addition there are a number of employer shuttles using vans or small buses that serve individual employers or groups of employers. (MTC estimates that there are about 170 small shuttle services in the Bay Area.)

Another new station access concept that is currently being explored is the use of "station cars" for short trips. Station cars could be reserved in advance by transit riders and used for the "last mile" of a passenger's trips from the station to their destination, where bus service, walking, or other means of transportation would take too long or be too inconvenient. Ideally, the station cars themselves would be low emission vehicles to reduce air emissions.

Improved rail/bus connectivity at key transit hubs is another aspect of improved access. MTC is currently evaluating improvements to regional transit connectivity in an ongoing study, and it is likely that there will be station specific recommendations for these hubs addressing signage, transit information, or specific physical modifications.

---

Many of these station access concepts were recently evaluated by MTC as part of the 2001 Ozone Attainment Plan set of Further Study Measures (FSM 5), and findings from the study are included in this TCM.

## **Description**

**Bike/Walk Access:** Improvements would include bicycle routes and lanes near transit stations, with connections to local and regional bike route networks; increased secure bicycle storage at transit, with bike stations at certain hubs; sidewalks, crosswalks, and direct pedestrian connections to nearby neighborhoods and activity centers, and better signage of bike/pedestrian access routes. This range of improvements is sometimes referred to as “Safe Routes to Transit”.

**Feeder Buses:** Improvements would primarily focus on the transfer arrangements between rail and ferries and the buses to make the transfer more convenient. New ferry routes and terminals and new rail stations will need to be developed in collaboration with local transit operators who will provide the feeder bus service.

**Station Cars:** These are vehicles that could be located at rail stations for use by transit riders who need to travel to destinations near the stations, but which do not have good transit service or are too far or inconvenient to bike/walk to. Station cars would be shared vehicles that could be checked out in advance. Transit riders would pay for the use of the vehicle depending on how far and long it is driven. Station cars would need to meet the most stringent vehicle emissions requirements for maximum air quality benefit.

**Shuttles:** Bay Area shuttles are operated by a diverse group of employers, cities, and other transit operators. Since most shuttles require operating subsidies, the main issue is the need to provide stable funding sources so that the successful shuttles can be sustained over the long term. There may be additional opportunities to establish new shuttle services, on a case by case basis. MTC analyzed new shuttle service in the 2001 Ozone Plan (Further Study Measure 5).

### **Phase 1 (2004-2006)**

- Develop demonstration program for station car and bike station concepts at selected regional transit centers
- Determine long term funding needs for existing shuttles and examine funding options
- Begin implementation of Safe Routes to Transit to improve bicycle and pedestrian access (RM 2 provides about \$20 million)
- Complete Regional Transit Connectivity Plan (MTC is required to complete plan by December 2005 under RM2)

### **Phase 2 (Beyond 2006)**

- Continue Safe Routes to Transit improvements
- Continue and expand other successful concepts from Phase 1
- Develop a master plan for implementation of bike stations or other innovative secure bicycle storage strategies at key transit hubs.

The Air District's Transportation Fund for Clean Air (TFCA) funds public agency improvements to bicycle and pedestrian access, and local feeder bus or shuttle service to rail and ferry systems. The TFCA program funds several shuttle projects currently operating in the Bay Area. The amount of TFCA funds allocated to these routes generally decreases over time, and there is no guarantee these routes will continue to receive TFCA funding in the future. Efforts should be



---

made to capture and retain the transit market created by the these shuttle routes. The Air District will work with transit operators to develop TFCA applications for new shuttle and feeder bus service to rail and ferry stations that reduce emissions.

The Air District's TFCA program and MTC's Transportation for Livable Communities program fund bicycle and pedestrian improvements at transit facilities.

### **Cost**

The cost of expanding fixed route feeder bus service is not known, and would depend on the operator and routes which would be expanded. Current operating costs vary between \$76 and \$114 per revenue service hour.

The cost of providing shuttles varies as well. Recent estimates for leasing a shuttle vehicle run between \$35 and \$75 per hour of service.

A very large station car program (1000 cars) would cost approximately \$25 million for the cars (assume hybrid/SULEV type vehicles) and about \$5 million per year in administration costs.

The cost of adding bicycle storage at transit stations depends on whether the storage is provided as an enclosed locker or through a more substantial Bike Station arrangement. Lockers are fairly inexpensive, costing about \$1,500. Bike Station costs vary considerably depending on the services provided, ranging from under \$100,000 for the Berkeley BART bike station to over \$700,000 for the downtown S.F. Caltrain bike station. Assuring long term operating costs for bike stations also must be considered. A comprehensive program of Safe Routes to Transit to BART stations could cost over \$45 million, as estimated by one bicycle advocacy group.

### **Effectiveness**

Emission reductions associated with TCM 5 are based on the following programs and assumptions.

- 1) An increase in feeder bus trips by riders who formally drove to rail/ferry
- 2) Additional bicycle access trips based on provision of new storage and safe routes to transit.
- 3) 24 new shuttle services to rail and ferries
- 4) 1000 car station car program.:

ROG  
TBD

NOx  
TBD

### **Impediments**

The ability of local transit operators to increase fixed route feeder bus service depends on availability of new operating funds, which are scare. While employers could underwrite the cost of shuttles, most of the time the costs are prohibitively expensive unless the employee pays a large portion. Comprehensive efforts to improve bike and walk access to a number of rail stations, will require new funding sources, such RM 2. An initial demonstration program for station cars at 4-6 stations may be able to access existing fund sources (CMAQ, RM2)

### **Travel Market Affected**

---

TCM 5 will affect all types of trips, including commute travel, shopping, personal business, social and recreational travel, and school trips.

### **Other Impacts**

This measure will improve traveler safety for pedestrians and bicyclists. Additional feeder and shuttle services would produce emissions which could be mitigated by retrofitting vehicles with catalysts (if diesel powered), or by purchasing CNG or electric vehicles. The measure could reduce local auto traffic and congestion around stations and alleviate potential auto parking shortages.

## **TCM 7 - IMPROVE FERRY SERVICE**

### **Purpose**

TCM 7 will reduce emissions from Transbay auto trips, which tend to be longer in length, and will also reduce auto traffic in highly congested bridge corridors. New high speed ferry service will offer a transportation alternative for crossing the Bay that is reliable, comfortable and provides a pleasant and relaxing travel experience. New ferry technology will result in overall emissions that are lower than those attributable to current passenger ferry service.

### **Background**

Freeways and bridges that serve Transbay travel are already heavily congested in the peak periods, and during portions of the weekend. The number of trips crossing the Bay is projected to grow at a higher rate than the regional average over the next 25 years. Existing ferry services have all been expanded with newer, high speed vessels on the Larkspur, Vallejo and Alameda/Oakland routes to San Francisco. In 1999 state legislation created the new Bay Area Water Transit Authority to plan and operate new ferry routes beyond those currently in service. Their work produced an Implementation and Operations Plan in 2003, which recommended an expansion of existing ferry service and an initial set of routes shown below:

- Pittsburg/Antioch-Martinez-San Francisco
- Hercules/Rodeo-San Francisco
- Richmond-San Francisco
- Berkeley-San Francisco-Mission Bay
- Oyster Point (South San Francisco)-San Francisco
- Redwood City-San Francisco
- Treasure Island – San Francisco

### **Description**

TCM 7 contains several elements. Phase 1 (2004-2006) primarily involves initial planning for new ferry service. A new low emission ferry will start Vallejo service in 2004. Phase 2 includes the start up of these services as well as further study into other possible new ferry service.

### **Phase 2 (Beyond 2006)**

- 
- Expansion of existing ferry service between Oakland/Alameda and San Francisco (two new vessels)
  - New intermodal transit hub at Vallejo Ferry Terminal
  - Expansion of service between Larkspur and San Francisco
  - New Berkeley/Albany service to San Francisco (two vessels)
  - New South San Francisco service to San Francisco (two vessels)
  - Expand berthing capacity at the Ferry Building in San Francisco
  - Feeder bus service to provide access to ferries (see also TCM 5)
  - Expand carrying capacity for bicycles on ferries (see also TCM 9)
  - Hydrogen fuel-cell ferry demonstration project from Treasure Island to San Francisco
  - Assist operators in converting vessels to lower emissions

Phase 2 will also include the continuing study of other new services, including:

- Potential new service between, Richmond, Hercules/Rodeo, Martinez, and Redwood City to San Francisco;
- Further study of using the Port of Sonoma
- Potential new service for passengers and cargo between Oakland and San Francisco airports

MTC has worked with ferry and other transit operators to develop transfer arrangements, including low cost transfers and joint passes (see TCM 13).

### **Travel Market Affected**

Transbay trips across the Bay bridges are projected to increase by 40% over the next 25 years, higher than the Bay Area average. This measure will focus primarily on peak period commute travel, when congestion on bridges is greatest. It will also provide an additional transportation option for shopping, personal business, and social and recreational trips. Tourism is also expected to generate a number of new riders for many of the ferry services.

### **Effectiveness**

TCM 7's emission reductions are based on MTC's analysis of the seven new services above. Emissions from the ferry vessels would be lower than those attributable to current passenger ferry service, given the WTA's commitment to the operate ferries that are 85% cleaner than the EPA's 2007 Tier 2 standards for marine vessels. Phase 2 improvements are expected to yield the following emission reductions:

<u>ROG</u>	<u>NO<sub>x</sub></u>
TBD	TBD

### **Cost**

New ferry service requires funding for vessels, terminals and parking, and feeder bus service. Funds for several new services (vessels and operating funds) were provided through voter approval of Regional Measure 2 in March 2004. Local jurisdictions together with County Congestion Management Agencies will need to prioritize funding for terminals in their local funding process. Future expansion of existing ferry services is uncertain given current transit funding problems.

---

The capital cost of the seven (7) new ferry routes (as estimated by WTA) is \$175 million (plus the cost for fuel cell project to Treasure Island), and the net annual operating cost is estimated to be \$90 million.

### **Impediments**

Passage of Regional Measure 2 provides partial funding for the Oakland/Alameda/Harbor Bay; Berkeley/Albany, and South San Francisco routes.. Planning for new ferry terminals, including environmental review and obtaining the necessary permits, could be lengthy depending on the site. Funding for feeder bus service to the new terminals will also need to be identified (see TCM 5).

### **Other Impacts**

System level environmental impacts of an expanded ferry system were recently analyzed by the WTA in a comprehensive EIR; impacts of individual terminals would be assessed in separate project level EIRs. New ferry service could impact existing transit operators by shifting some existing passengers to water transit, resulting in some revenue diversion. New ferry terminals may result in traffic impacts on neighborhoods near the terminals. There could also be an increase in cold start emissions from the increase in passenger vehicles parked at ferry terminals during the workday.

An extensive system of ferries could add to the attraction of the Bay Area as a tourist destination and provide an economic stimulus.

Another major advantage of an expanded ferry system would be the role ferries would play in the event of a future earthquake that damaged one or more Bay bridges or BART. If an earthquake were to strike the Bay Area (highly probable over the next 30 years), ferries could play a vital role in post quake evacuation and in the immediate to longer term recovery period.

## **TCM 8 - CONSTRUCT CARPOOL / EXPRESS BUS LANES ON FREEWAYS**

### **Purpose**

The California Air Resources Board considers an HOV lane network to be a "reasonably available" transportation control measure. This TCM could help reduce mobile source emissions by continuing the development of an integrated Bay Area HOV lane system that will encourage use of carpools, vanpools and other high occupancy vehicles (HOVs), such as express buses. Well managed HOV lanes will encourage commuters and other trip makers to use high occupancy modes by providing faster more reliable travel compared to travel in the adjacent mixed flow freeway lanes. HOV lanes act in combination with other factors that influence carpooling and transit, such as free passage on the Bay bridges and limited or high cost parking in some areas.

### **Background**

The Bay Area currently has 295 lane miles of HOV lanes, including freeways and expressways (in Santa Clara County). Another 70 lane miles are programmed in MTC's current Transportation Improvement Program. Monitoring of existing HOV lanes by Caltrans indicates that most all of these lanes carry considerably more people than the adjacent mixed flow lanes. Under state law, alternatively fueled vehicles identified with a sticker may also use the HOV lanes.

MTC periodically reviews HOV lane performance and updates the Bay Area HOV Lane Master Plan. Recommended HOV lane improvements are then included in the Regional Transportation Plan and programmed in the TIP. The latest HOV Master Plan would expand the system to 534 lane-miles. The HOV Master Plan also addressed other related issues, such as HOV lane

---

occupancy requirements, hours of operation, and enforcement. The latest update (February 2003) also included a comprehensive analysis of regional emissions from different HOV lane configurations, including conversion of existing lanes to HOV lanes, raising occupancy requirements to 3+ on all HOV lanes, and providing exclusive lanes for express buses.

## **Description**

The measure primarily addresses the physical configuration of the HOV lane system and operational requirements. Express bus service is addressed under TCM 3. The Phase 1 HOV lanes are those included in MTC's current Transportation Improvement Program (TIP), whereas the Phase 2 lanes are those in the long range Regional Transportation Plan.

### **Phase 1 (2004-2006)**

- 70 new miles of HOV lanes programmed in 2003 TIP
- New HOV to HOV lane connector at Rt 101/85 interchange in Mountain View
- New park and ride lots at various locations

### **Phase 2 (Beyond 2006)**

- The 2001 RTP includes funding for an additional 144 lane miles beyond those in the TIP, plus other park and ride lot projects

Phase 2 will also include the further development of HOV lane support infrastructure and programs, including strategically located park and ride lots, HOV bypass lanes at freeway on ramps, direct access HOV ramps ("slip ramps") for carpools and buses to major employment centers, HOV-to-HOV lane freeway connectors to better integrate the entire network, possible use of freeway shoulders by express buses to bypass bottlenecks, and active enforcement of occupancy and use restrictions.

Increases in certain express bus services will be considered to maximize person carrying capacity of HOV lanes. TCM 3 discusses regional express bus service, which would be operated on HOV lanes in the Bay Area.

Average vehicle occupancy of all HOV lanes should be carefully monitored. MTC's HOV Lane Master Plan predicts that by 2010, seven corridors will have HOV lane volumes in excess of the practical capacity of 1,600 vehicles per hour, and by 2025 15 out of 18 HOV corridors will exceed this volume. An increase in vehicle occupancy from 2+ to 3+ would normally be considered after other feasible corridor management strategies (Express Bus, expanded CHP enforcement, ramp metering, etc.) have been deployed.

As congestion continues to increase in the Bay Area and the length of the peak period expands, the Bay Area should consider moving toward a consistent regionwide set of hours (this would correspond to the current maximum spread of 5:00 a.m. to 10:00 a.m. and 3:00 p.m. to 7:00 p.m.). Additionally, there may be selected corridors and travel directions where hours of operation could be extended to mid-day hours (10:00 a.m. to 3:00 p.m.) based on travel conditions in the mixed flow lanes and the number of transit, carpools and vanpool users who could take advantage of these lanes.

## **Travel Market Affected**

TCM 8 is aimed primarily at commute trips, which account for the majority of trips during the morning and evening peak periods. In the future, HOV lanes should help to increase average vehicle occupancy for other types of trips as hours of operation are expanded (e.g., shopping, personal business, school, recreational).

---

## Effectiveness

MTC has estimated the regional emission reductions associated with the proposed HOV Master Plan update (total system of 534 miles) as shown below. Additional information on other configurations can be found in MTC's full report on Further Study Measures in the 2001 Ozone Plan

ROG  
TBD

NO<sub>x</sub>  
TBD

## Cost

The cost of the HOV lanes in the 2003 TIP is \$1.2 billion, and the cost of additional lanes in the 2001 RTP is \$770 million. New county sales tax measures, if passed by voters, could provide funding for new HOV lanes in some counties (e.g., Sonoma Route 101).

## Impediments

A review of the history of HOV lane violation rates indicates that there has been a dramatic improvement in HOV lane compliance, with only one lane exceeding the national average. However, continuing monitoring is important to preserve public support. Evaluation of future HOV lane performance in the HOV Lane Master Plan indicates that some lanes could become overcrowded in the future, and it may be necessary to consider changing occupancy requirements to preserve travel time savings; however, public resistance to such changes may be difficult to overcome.

## Other Impacts

Increasing the use of carpools, vanpool, and express buses will have significant payoffs in conserving fuel, reducing dependence on foreign oil, and lowering greenhouse gas emissions. TCM 8 may have a short term negative impact on air quality due to emissions generated during construction and increased localized congestion.

HOV lanes outside the urban core may have some marginal impact on land use by making longer distance commuting more attractive. However, development decisions involve many other factors as well, and ABAG's adoption of a Smart Growth land use scenario (see TCM 15) is intended to focus more population growth in the Central part of the Bay Area, where HOV lanes will provide an important augmentation to mobility.

A well developed HOV lane network could serve as the foundation for conversion of these lanes to a High Occupancy Toll Network as discussed in TCM 18.

## TCM 9 - IMPROVE BICYCLE ACCESS AND FACILITIES

### Purpose

Bicycles are a low cost, widely available (60% of Bay Area households have at least one bicycle) and pollution free mode of transportation. TCM 9 will reduce mobile source emissions by expanding bicycle facilities serving employment sites, educational and cultural facilities, residential areas, shopping districts, and other activity centers. Typical improvements would include bike lanes, routes, paths, and bicycle parking facilities. Accessibility of transit to bike riders is also part of this TCM.

---

## Background

According to the 1995 Nationwide Personal Transportation Study, 40% of all trips are two miles or less, and two-thirds are five miles or less. One-third of Bay Area employees live within five miles of their worksite. These short and medium length trips are well suited to bicycle travel, especially in the Bay Area's mild climate.

While a number of factors influence people's decisions about whether to use bicycles for their trip, key obstacles are the lack of safe and convenient bicycle routes and storage. Currently bicycles are widely used for recreational riding, but are less used as a commute mode, with only 1% of total daily trips being made by bike (compared to 9% by walking), or for other trips such as shopping or school trips. Greater use could be expected with a variety of local and systemwide improvements. MTC's 2001 Regional Transportation Plan defined a regional bike network for the first time, and MTC has decided to set aside funding in the Transportation 2030 Plan to complete critical gaps in this network.

Experience in cities such as Palo Alto, Davis, Seattle, and Portland, Oregon shows that bicycles can play an important role in local transportation. To obtain TDA funding from MTC local jurisdictions must have a Bicycle Advisory Committee to plan and prioritize funding for bike projects. These plans can also address related bicycle mobility and safety features such as signage, bike detectors at signals, safe lane widths, etc. Also, a number of Bay Area cities routinely incorporate bicycle improvements when maintaining or upgrading local streets.

Bicyclists also use transit extensively for their longer trips, and most Bay Area transit systems currently accommodate bikes (though some have restrictions during peak commute times). Buses accommodate bikes either through front mounted racks or on board of they can be folded. BART and Caltrain accommodate bikes on their trains, but with some restrictions. The Regional Express buses accommodate bikes with front racks as well.

A special issue for the bicycle community has been the provision of bike lanes on the Bay bridges. Bay bridges with bicycle lanes currently include the Golden Gate, new Carquinez Bridge, Antioch, and Dumbarton bridges. New bridges under construction that will include bicycle lanes are the new eastern span of the Bay Bridge (Oakland to Treasure Island) and new Benicia Bridge. A feasibility study has been completed of installing bike lanes on the western portion of the Bay Bridge (costs range from \$160 million to over \$300 million), and a study is being conducted of bicycle access across the Richmond-San Rafael Bridge.

## Description

TCM 9 would focus on improvements to the Regional Bike Network defined in MTC's 2001 Regional Transportation Plan. TCM 9 also supports local efforts to provide bicycle access and amenities and to better integrate bicycles into roadway improvement and Caltrans' efforts to consider non motorized travel in all of their plans, programs, and projects.

The TCM includes the following types of programs and activities:

- MTC's Regional Bike Plan consists of over 600 miles of bike routes. MTC's proposed Transportation 2030 Plan provides \$200 million in funding to complete critical links and to leverage local funds to construct even more facilities. As part of MTC's monitoring of the regional transportation system, MTC collects bike counts at a number of heavily traveled bike facilities.
- MTC and Air District grant programs fund bicycle improvements.

- 
- Caltrans Deputy Director Order 64 requires Caltrans to incorporate non-motorized transportation options in design and construction of state highway facilities.
  - Many local jurisdictions have developed bike plans and incorporate bike facilities when they rehabilitate or improve their local arterials (for example, in Santa Clara County).

Improvements to bicycle access and facilities is also discussed in TCM 15, Local Land Use Planning and Development Strategies and TCM 20, Traffic Calming.

#### **Phase 1 (2004-2006)**

- Fund Regional Bike Plan improvements (specific projects TBD)
- Develop on line bicycle mapping tool as part of the regional 511 traveler information number (MTC)
- Bike to work day promotion (MTC)
- Funding for bike improvements included in MTC's Transportation for Livable Communities (TLC) projects
- The Air District's TFCA program funds bicycle routes, storage and other facilities.
- Funding for other local bicycle improvements through local sales tax measures and state TDA Article 3 funds
- Fund Safe Routes to Transit improvements (see TCM 5).
- Encourage local jurisdictions to continue to develop safe and convenient networks of bicycle lanes and routes.
- Encourage local jurisdictions to provide bike racks or other secure storage in downtowns, shopping areas, and other activity centers.
- Encourage local jurisdictions to require bicycle access and amenities (e.g., bike storage, showers and lockers, etc.) as conditions of approval of development proposals.

#### **Phase 2 (Beyond 2006)**

- Generally a continuation of the above activities, but with the potential for additional funding from passage of local sales tax measures for transportation in various counties.
- Additional emphasis on bicycle training and safety related projects, including public education for both bicyclists and motorists

#### **Travel Market Affected**

TCM 9 will promote bicycle use (or bicycles combined with transit) for the entire range of local trips, including commuting, shopping, personal business, and social and recreational travel. The potential market for TCM 9 is significant, given that short distance trips of less than five miles account for the majority of all trips in the region.

#### **Effectiveness**

The emission reductions below represent a higher bicycle mode share for regional trips, assuming an aggressive development program that would increase the overall mode share from 1% to 2%.

ROG  
TBD

NOx  
TBD



---

## **Cost**

MTC's current 2001 Regional Transportation Plan provides over \$400 million for bike improvements over the 25 year planning period. The cost of completing MTC's Regional Bike Plan is estimated to be \$625 million, and as mentioned above, the new 2030 Transportation Plan will provide a dedicated source of funding to help complete this network. Annual TDA Article 3 funding produces about \$3 million per year for local bike improvements throughout the Bay Area, which can be applied to a wide variety of projects. MTC's TLC/HIP program also funds local community based projects, many of which involve bike facilities or bike related improvements. The Air District's TFCA program funds bicycle lanes, routes and bridges, bike racks and lockers, and other projects.

## **Impediments**

Widespread use of bicycles is limited by a number of factors, including the user's physical ability, terrain, weather, need to carry cargo or packages, etc. Personal safety is another concern for riders who may not have extensive experience in riding in different traffic conditions, but can be addressed through training and by providing bike lanes and other safety improvements. Public education for motorists and cyclists to obey traffic laws and "share the road" would also improve safety. While most transit operators have formulated workable arrangements for accommodation of bikes, increased accommodation of bikes during peak passenger loads will still present operational issues for some operators. Dedicated bike lanes across some bridges may be extremely expensive or operationally infeasible. Bicycle accommodation at work sites may create additional costs for employers.

## **Other Impacts**

Bicycles have low impact on the environment across all resource categories. Some major bike facilities may have localized environmental impacts that would be addressed in project specific EIRs. Since bicycles are an excellent means of physical exercise, TCM 9 will also promote public health. Increased bicycle use may reduce the need for auto parking at some employment or residential sites and transit stations.

# **TCM 12 – ARTERIAL MANAGEMENT MEASURES**

## **Purpose**

Arterial traffic controls include signals, stop signs, and yield signs. Coordination of signals on major arterial routes can reduce vehicle idling and acceleration by dedicating extra "green" time to the major traffic direction and thereby reducing vehicle emissions. Bus operations will also benefit from these strategies through faster and more reliable travel times.

## **Background**

Over 40% of daily regional vehicle miles of travel (VMT) occurs on arterials. By coordinating the operation of multiple signals, vehicles can travel at fairly constant speed over a long route, reducing stop and go emissions. Close to 60% of 7000 signals in the Bay Area are currently subject to some kind of coordination. Advanced technologies allow signal timing plans to be reset based on actual traffic conditions at an intersection or group of intersections. Signals may also be adjusted from a central traffic management facility that manages large signal systems. For all signal systems it is important from an efficiency standpoint to ensure that their signal timing plans are periodically updated to reflect changes in local and areawide traffic conditions over time.

---

Additionally, most local bus routes use arterials, and their operations can be impeded due to local traffic congestion which slows buses and reduces schedule reliability. Improving the performance and reliability of buses on arterials can stimulate increased ridership. Slower bus travel times also results in more buses being required to provide the desired headways. Signals can be equipped with software to extend the green time or switch the signal to green earlier to move buses faster and help maintain the schedule..

## **Description**

This measure includes both the coordination of signals that have not yet been coordinated as well as the periodic retiming of signals that are coordinated to update their timing plans based on current traffic conditions. Of the approximately 2,500 signals in the Bay Area that have not been coordinated, it is estimated that roughly 50% are near enough to another coordinated signal to merit coordination. Also, for the 4,400 signals that have already been coordinated, the basic feature of this TCM is the updating of their timing plans to ensure they are optimized for current traffic conditions.

Arterial management projects should pay careful attention to the needs of transit. Cities and counties should assure that retiming plans include discussions with transit operators to determine whether it is feasible and desirable to implement bus priority treatment on an arterial. Arterial management strategies that can enhance transit operations include dedicated transit-only lanes, queue jumper lanes at intersections, signal priority, bus bulbs, increased enforcement of bus loading zones, and relocation of bus stops. Reports on the effectiveness of transit signal priority systems indicate that they could provide up to 15% improvement in travel time along a given route.

MTC also provides technical assistance grants to local jurisdictions to update signal timing plans. Another intersection treatment that can be evaluated, if local conditions permit, is development of "roundabouts", which allow intersecting traffic streams to move in a circle around an intersection, thus eliminating vehicle stops and idling associated with traditional signalized intersections. (Roundabouts are employed extensively in the United Kingdom and throughout Europe.)

### **Phase 1 (2004-2006)**

- Maintain current technical assistance program (MTC) for local jurisdictions that wish to retime signals; the program will also encompass evaluation of bus priority treatments as part of retiming plans.
- Continue Air District TFCA program to fund projects to improve arterial conditions.

### **Phase 2 (Beyond 2006)**

- Coordinate additional 1,200 signals and continue updating timing plans
- Working with bus operators, provide priority treatment along major bus routes

## **Travel Market Affected**

TCM 12 will affect the entire range of trips made on arterials, including commute travel, school travel, shopping, personal business, recreation, and commercial travel.

## **Effectiveness**

The emission reduction calculations include two components: 1) coordination of an additional 1,200 new signals, and 2) retiming one fifth of the existing coordinated signals each year.

---

ROG  
TBD

NOx  
TBD

### **Cost**

The cost of coordinating/retiming signals is about \$1,200 per signal. Advanced signal software and development of centralized traffic management centers would add to this cost and would vary depending on the sophistication of the installation.

### **Impediments**

The main impediment to maintaining a well coordinated signal system is the interest and level of effort required from local governments who have had to reduce staff resources due to financial pressures. Where signal coordination on an arterial requires cooperation of multiple jurisdictions, the negotiations can take time to resolve both technical and policy issues.

### **Other Impacts**

Optimized signal timing plans have been shown to be potent strategies for reducing automobile fuel consumption, and the attendant greenhouse gas emissions (early interest in signal timing sprang up during the fuel crisis of the early 70's and 80's). To the extent that bus priority treatments improve travel times and schedule reliability, ridership and transit revenues could increase. Also consistent travel time savings could allow operators to serve a high volume route with fewer buses, saving capital and operating costs.

It is also critical that arterial management projects carefully consider pedestrian and bicyclist safety. Reducing idling and stop and go traffic can reduce emissions, but arterial improvements – particularly those that speed the flow of traffic – should also assure that pedestrian and bicycle safety is preserved and enhanced. Measures to enhance pedestrian and bicyclist safety include: prominent crosswalks and pedestrian signals; signage and striping; provision of or improvements to mid-block crossings; bicycle loop detectors for signals; and consideration of bicycle access in planning new arterial construction or modifications. Bike/ped safety on arterials is also discussed in TCM 20, Traffic Calming.

## **TCM 13 - TRANSIT USE INCENTIVES**

### **Purpose**

TCM 13 will focus on programs that could potentially increase transit use and lower vehicle emissions, such as monetary incentives, better transit information, deployment of a universal fare card for transferring between operators, and better signage at transit stops and transfer locations.

### **Background**

With 26 different transit operators in the Bay Area, transit users need convenient ways to plan trips, transfer between operators, and pay fares. Through cooperative efforts between MTC and the Bay Area transit operators, new technologies and strategies are being developed to make transit trips more convenient and to take less time.

Transit fare policies are determined by the policy boards of the individual operators, but MTC is developing a new universal fare card (Translink) to make fare collection easier and to make it easier for riders to transfer between systems. Under state law, MTC requires each transit agency in the region to maintain a fare/transfer revenue sharing agreement with every connecting agency. The ability of transit operators to stimulate ridership growth by providing discounted fares for

---

different age groups or various trip purposes depends on the individual operator's revenue base and the ability of the operator to pay for ongoing operating costs as well as longer term capital replacement needs. Increasing fares can decrease ridership, and has a particularly adverse impact on low income transit users. (MTC is currently conducting a study of overall transportation affordability.)

Various operators have also designated key transit hubs or centers for improvement (e.g., AC Transit's Comprehensive Service Plan which is developing 11 transit centers, 6 at BART stations), and these improvements are being made as funding becomes available.

## **Description**

TCM 13 includes the following:

### **Phase 1 (2004-2006)**

- TransLink®. TransLink is a program that utilizes "smart card" technology for the collection of fares on all the region's transit systems. It will significantly improve the convenience of fare payment and collection. The universal fare card is being deployed on transit systems throughout the region, making it easier for riders to use multiple transit systems and providing an improved revenue tracking mechanism for transit operators. The initial phase will include deployment of Translink with the major transit operators.
- Improvements to the 511 transit information service. Information for trip planning can be obtained by calling 511, which connects people to the individual transit operator, or through web based information on the internet at <http://transit.511.org/>. Web based transit information is also available for planning trips.
- Commuter Check/Ecopass. The Commuter Check program, which sells transit vouchers to employers who then give them to employees to purchase tickets and passes, continues to expand with over \$12 million in annual sales. A similar type of program in Santa Clara County, called EcoPass, provides discounted tickets to employees through their employer. Residential EcoPass programs have also been implemented. MTC and the Air District will encourage employers, transit operators, local governments and others to promote and expand such programs.
- Improved signage at transfer hubs. MTC's Transit Connectivity Study is addressing the need for better signage and other information at transfer hubs, which would be a low cost improvement. The Study will be completed in early 2004, with Regional Measure 2 providing funds for an expanded effort.

### **Phase 2 (Beyond 2006)**

In addition to the continuation of the efforts above, additional activities would include:

- Deploy real time transit arrival information. Bay Area transit operators are in different stages of studying and deploying equipment to provide real time bus/train arrival information. (BART has electronic arrival information signs, Muni is planning on a systemwide application, and AC Transit has installed bus arrival information signs along the San Pablo Ave. enhanced bus route.) Real time information improves the transit experience by removing uncertainty in knowing the arrival time for the next vehicle, minimizing waiting time, and increasing a passenger's sense of security for late night trips.
- Increased amenities at transit hubs and stops. The purpose for providing new amenities at transit hubs would be to improve comfort and convenience for riders and create a sense of "place" by having food, retail activities, restrooms, improved shelters, lighting improvements, etc. These improvements enhance the transit experience for riders, particularly regarding the quality of service and ease in making transfers.

- 
- Complete transit centers as identified in AC Transit's *Comprehensive Service Plan* in Alameda and Contra Costa Counties.

### **Travel Market Affected**

TCM 13 will make transit a more attractive and convenient option for a wide range of trips. Measures to promote the sale and subsidy of transit passes through employers focus on commute travel, whereas other measures would improve convenience for all types of transit trips.

### **Effectiveness**

While it is likely that these types of activities could attract new riders to transit, the diversity of the measures and indirect manner in which they influence travel choices makes it difficult to assign specific air quality emission reductions to them. For example, several European studies of real time transit information attribute ridership gains of up to 5% with these systems, but it is not clear that the same results would be transferable to other locations.

### **Cost**

Annual costs for various types of programs are provided below:

TransLink®

511

Commuter Check. The RTC Clearinghouse and Commuter Check program cost approximately \$400,000/year

Real Time Transit Arrival Information. With the passage of Regional Measure 2 in March 2004, about \$20 million in competitive grant funding will be available to implement real time transit information systems (the cost of large scale deployment is unknown because of the different types of systems and applications which are being considered in the Bay Area by different transit operators). Priority will be given to projects identified in MTCs Transit Connectivity Plan mentioned above..

### **Impediments**

Most of the key elements of this measure are already in a mature stage of deployment. Development of more ubiquitous transit arrival information will depend on resolution of technological issues among by different transit operators and new funding. Provision of enhanced transit amenities at hubs will require new funding.

### **Other Impacts**

TCM 13 is likely to enhance the overall perception of the quality of transit service in the Bay Area, and would have indirect benefits for reduced auto fuel consumption and greenhouse gas emissions to the extent the combination of strategies above produce new transit riders. Deployment of of real time transit information systems result in an unknown additional claim on transit operating funds.

---

## **TCM 15 - LOCAL LAND USE PLANNING AND DEVELOPMENT STRATEGIES**

---

## **Purpose**

Land use patterns directly affect how we travel between homes, jobs, schools, shops and services, and other destinations. Motor vehicles are a major source of ground-level ozone precursors, fine particulates, toxic air contaminants, carbon monoxide, and other air pollutants. TCM 15 seeks to reduce motor vehicle use and emissions by promoting land use patterns and development projects that facilitate walking, bicycling and transit use.

## **Background**

The Air District since 1986 has encouraged local governments to address the air quality impacts of all local activities by incorporating air quality elements or sections into their general plans. Since 1999 the District, ABAG, MTC and the Bay Area Alliance for Sustainable Communities have undertaken the Smart Growth Strategy/Regional Livability Footprint Project. The goal of the Smart Growth Project is to develop and implement a preferred land use vision for the region to promote environmental quality, economic vitality and social equity. During an extensive public workshop process, workshop participants identified a vision for the region that favors compact, mixed use development near transit stations, transit corridors and town centers. The Smart Growth vision is reflected in ABAG's Projections 2003, and will inform the Regional Transportation Plan (Transportation 2030), air quality strategies, and implementation programs of the regional agencies.

The California Clean Air Act (CCAA) requires regional clean air plans to include indirect source control programs to encourage developments, as well as local and regional plans, that:

- Minimize dependence on motor vehicles and, thereby, reduce air contaminant emissions;
- Require mitigation of adverse air quality impacts of facilities that do attract a significant volume of motor vehicle traffic.

TCM 15 responds to the indirect source requirements of the CCAA and the increasing understanding of the connection between land use, transportation and environmental quality as reflected in the Smart Growth Project.

## **Description**

The location, mix, intensity and design of development influence travel choices. Communities can promote transit, walking and cycling by encouraging compact, infill development providing a mix of uses at moderate or high densities.

Local governments can address the land use/transportation/air quality connection through planning and development policies and programs. Cities and counties can integrate air quality-beneficial policies and programs into general plans and related implementation programs such as subdivision regulations, zoning ordinances, capital improvement programs, parking requirements, and development design guidelines. Localities can produce separate air quality elements, or can incorporate air-quality beneficial policies into the land use, circulation/transportation, and other required elements of the general plan.

Local governments and transit districts can prepare specific plans for downtowns, transit stations, and other activity centers. Development patterns can support transit, walking and cycling in various ways, including:

- focusing higher density development near transit stations and corridors
- Encouraging compact development with a mix of uses that locates housing near jobs, shops and services, schools, and other community facilities

- 
- Encouraging infill development
  - Locating shops and services near employment centers
  - Designing streets, sidewalks and bike routes to ensure safe and convenient access for pedestrians and bicyclists
  - Designing development projects to provide safe, convenient pedestrian access to transit stops and nearby services
  - Reducing parking requirements

#### **Phase 1 (2004-2006)**

MTC's Transportation for Livable Communities (TLC) planning grants fund local planning programs to promote community revitalization. .

MTC will consider a new planning grant program to fund specific plans around transit stations and corridors.

MTC's TLC capital grants fund local projects that promote transit, walking and cycling.

MTC's Housing Incentive Program (HIP) provides financial incentives to cities to provide high-density housing near transit stations and corridors.

MTC's "T-Plus" program will provide funding to each county congestion management agency to promote community revitalization projects.

The Air District's Transportation Fund for Clean Air (TFCA) funds bicycle projects, traffic calming, shuttles, low emission vehicles, trip reduction programs, and other clean air projects. Funding levels average approximately \$20 million/year.

ABAG will periodically update and monitor its Smart Growth demographic Projections.

MTC will include in the RTP a transportation/land use policy statement.

MTC will develop incentives and conditions to promote supportive local land use policies around major new transit investments that generate ridership sufficient and make new transit investments economically viable.

MTC, ABAG and the Air District could develop financial and other incentives to encourage innovative parking strategies to promote reduced amounts of parking, parking fees, and other parking programs. Cities and counties have authority over parking policies. Local governments could take various actions to promote innovative parking strategies, including:

- Reduced parking requirements. Reduce parking requirements, particularly at transit oriented and infill development, mixed use projects, senior and affordable housing, and other appropriate locations.
- Shared parking. Promote shared parking at mixed use projects and other appropriate locations.
- Parking fees. Raise public parking fees, and consider residential permit programs to alleviate spillover concerns.
- Parking cash out. Promote parking cash out through outreach, financial assistance, and requirements through CEQA processes or conditions of approval.

- 
- Technical assistance. Maintain examples of best practices and innovative parking strategies. Highlight and publicize through workshops, guidance documents, awards, and other methods.

MTC, in cooperation with transit operators and local governments, will examine promising opportunities for transit oriented development.

ABAG will promote multi-jurisdictional planning along selected transit corridors to encourage transit oriented development.

MTC, ABAG and the Air District will pursue legislative changes to remove barriers and provide incentives for smart growth.

MTC, ABAG and the Air District will engage in outreach and public involvement processes to build support for smart growth programs.

The Air District, MTC and ABAG will explore ways to promote carsharing as a way to reduce parking requirements. The regional agencies and cities and counties could support carsharing through financial incentives, helping secure additional parking, assistance with marketing, and pilot programs. Emphasis should be placed on hybrid and SULEV vehicles to maximize air quality benefits.

The Air District will monitor implementation of indirect source mitigation programs in other regions for potential feasibility in the Bay Area.

The Air District, MTC and ABAG will consult with and provide technical assistance to local jurisdictions interested in pursuing smart growth strategies.

The Air District, MTC, and ABAG will highlight and publicize noteworthy examples of local clean air plans, policies and programs, as well as noteworthy development projects.

Cities and counties are encouraged to require the provision of bicycle access and facilities (e.g., bike lanes/routes, secure parking and showers/lockers, where appropriate) at developments such as employment centers, shopping centers, and residential complexes (see TCM 9).

Cities and counties should assure that local plans, policies and programs encourage walking and promote a safe and convenient pedestrian environment (see TCM 19).

Cities and counties, in cooperation with transit providers, should prepare transit station area plans for appropriate transit stations and transit centers, with the goal of promoting higher density, mixed use development, multimodal connections and convenient pedestrian access in order to increase transit use, walking and other alternative modes.

The Air District will continue to provide technical support to local jurisdictions and others on air quality analyses in environmental review processes.

The Air District encourages cities and counties to develop strategies to reduce emissions from sources other than motor vehicles, such as lawn and garden equipment, woodstoves and fireplaces, and residential and commercial energy consumption.

The Air District, ABAG and MTC will study opportunities to promote location efficient mortgages (LEMs) to encourage home purchases near transit.

## **Phase 2 (Beyond 2006)**



---

Implementation of smart growth strategies will occur over many years. MTC, ABAG and the Air District will continue the programs listed above, and refine and augment them as appropriate, in future years. Budgetary and legislative constraints may influence long-term programs.

### **Travel Market Affected**

Local planning and development to improve air quality and reduce motor vehicle travel will address all types of trips—commute, shopping, school, recreation, social, and personal business.

### **Effectiveness**

TCM 15 is expected to yield the following emission reductions:

$\frac{\text{ROG}}{\text{TBD}}$	$\frac{\text{NOx}}{\text{TBD}}$
---------------------------------	---------------------------------

This TCM would reduce emissions over the long term by promoting better integration of land use and transportation at the local level and by supporting the implementation of the other TCMs in the Ozone Strategy.

### **Cost**

It is impossible to quantify costs associated with this measure. Costs would include preparation of general and specific plans, development review and environmental clearance, public capital investments, private investment in development projects, and other costs. Costs would be offset by rents and tax revenue from new development.

### **Impediments**

Because the Smart Growth land use pattern results in accommodating more people in the urban core with more in fill type development, there will sometimes be jurisdictional and neighborhood concerns with increased density, traffic, localized air pollution and other impacts. Providing appropriate levels of transit service for this new development will require additional funding. A full range of incentives will need to be developed, which will take time and possible legislative action. Local governments may have limits to the staff resources available to making major changes in their plans and zoning to reflect the Smart Growth projections..

### **Other Impacts**

Local plans, policies and programs that effectively integrate land use, transportation and air quality considerations can help cities and counties achieve the following benefits:

- Preserve open space, agriculture and other land resources
- Improve housing supply and affordability
- Reduce long distance commuting
- Increase mobility
- Conserve energy
- Improve water quality
- Use infrastructure and land more efficiently
- Increase transit ridership

- 
- Improve economic competitiveness
  - Enhance community attractiveness and quality of life

The Smart Growth Strategy/Regional Livability Footprint Project preferred land use vision will provide emission benefits in neighboring counties as more housing is provided in the Bay Area, cutting down on long distance in commute trips. MTC analyzed effects in neighboring counties and estimated roughly a 2.8% decrease in VMT and ozone precursor emissions.

## **TCM 18: IMPLEMENT TRANSPORTATION PRICING REFORM**

### **Purpose**

There is growing interest in new strategies to price the use of the region's transportation system that could have long term implications for improving air quality and addressing persistent congestion issues. Pricing of transportation facilities would not only affect travel behavior, but would generate new revenues for future transportation improvements and for TCMs in this plan. Sound economic principles require a link between the cost of providing transportation facilities and services and the cost of using them; however, recent transportation funding decisions have decreased the proportion of funding from user based charges (such as gas taxes and tolls) and increased reliance on non user charges (such as local county sales). A variety of pricing strategies have been suggested to restore and better link the price of transportation with user demand and with the indirect costs of transportation consumption related to air and water quality impacts.

### **Background**

Gas taxes have been the historic means for paying for transportation improvements, and as prices increase motorists generally will curtail some of their travel. Federal and state taxes currently amount to about 36 cents per gallon, and have not increased in over a decade. Increases in fuel efficiency and increased use of alternative fuels also reduce revenues from gas taxes. The arguments for new transportation fees are based on the need to provide enhanced transportation choices as much as they are on providing near term emission reductions. In order to affect the number of trips and amount of travel made by autos, pricing strategies would need to significantly increase the cost of gas, tolls, parking, etc., to levels that probably are not currently acceptable to the public (particularly given the already high cost of living in the Bay Area). Public surveys of interest in increasing the gas tax, even at modest levels of 10 cents per gallon, show significant public opposition. Efforts to secure legislative interest in strategies such as congestion pricing on the Bay Bridge also have failed to garner enough support to advance this concept, even as a demonstration project. Thus, the theory and implementation of new strategies must be coupled together in a pragmatic approach, and include outreach to business and environmental organizations and the public at large to build support for these measures.

Specific traffic management fees include congestion pricing (fees change by time of day), High Occupancy Toll (HOT) lanes (solo drivers pay to access freeway carpool lanes where they would otherwise be prohibited), and cordon pricing (such as the fee paid to drive in central London).

Vehicle based fees that could encourage motorists to purchase low or zero emission cars included registration fees and fees based on the emission characteristics of the car and amount of mileage driven.

Parking availability and the pricing of parking are also key determinants in how often people use their vehicles and are discussed under TCM 15.

With all of the above pricing concepts, the new revenue could be applied to transit, carpooling, bicycle facilities, pedestrian improvements, and other programs to enhance alternatives to driving alone. Or they could be used for some system management programs that lead to more efficient

---

vehicle operations, or approaches to reduce emissions from more polluting vehicles, such as diesel vehicles.

Although pricing measures offer potential for reducing air pollution and congestion, certain aspects of these fees could have disproportionately large effects on low income households, and would have to be designed with remedies in mind.

### **Description**

Pricing measures under this TCM would require close cooperation between the Air District, MTC, the business community and other stakeholders to develop legislative support. This TCM would consist of the following pricing options:

#### **Phase 1 (2004-2006)**

- **Higher Bridge Tolls.** Regional Measure 2 will increase bridge tolls, by \$1. Higher bridge tolls will have a modest impact on shifting Transbay trips to various modes of transit. Bridge tolls are still relatively inexpensive compared to similar tolls on other bridges around the country.
- **Gas Tax Increase.** MTC has authority for placing a regional gas tax measure on the ballot for up to a \$0.10 increase over 20 years. Through periodic polling, MTC will continue to investigate the viability of proposing a regional gas tax to Bay Area voters (which would currently require a 2/3 margin of approval). This measure would include building legislative and public support for higher federal and state gas taxes, either through a tax increase or indexing current taxes to keep up with inflation. In addition, in the 2004 legislative session, two bills have been proposed that would increase gasoline and diesel taxes to provide additional revenue for transportation and air quality programs.

#### **Phase 2 (Beyond 2006)**

- **Congestion Pricing.** MTC and the Air District will continue to test legislative support for congestion pricing on the Bay bridges. If authorized by the legislature, MTC and Caltrans will begin a demonstration of congestion pricing. If this demonstration is successful, congestion pricing may be expanded to other bridges in the region.
- **High Occupancy Toll (HOT lanes).** The most likely lane to be developed for testing this concept would be in the I-680 corridor (Sunol Grade), and would allow single occupant vehicles to pay for using the carpool lane to avoid congestion in the adjacent mixed flow lanes. Additionally MTC will be investigating the concept of a much more extensive system of HOT lanes, using the existing HOV system as a foundation for this network. Surplus revenues (those available after paying for the direct operating costs) generated by a HOT lane could be used to pay for expanding the HOT network or for commute options in congested corridors. Real time pricing would also be considered, which would factor in the value of the travel time savings compared to slower travel in the more congested mixed flow lanes. A preliminary evaluation by MTC of the air quality benefits shows decreases in VOC and increases in NOx. Any HOT lanes pursued under this TCM should be those showing the greatest emission reduction benefit.
- **Regional and State Gas Tax Increases of up to 50 Cents per Gallon.** This measure would consist of a 10 cent regional gas tax and an additional amount equal to the current federal and state tax. The increase in federal and state taxes can be supported by the rising cost of maintaining the existing transportation infrastructure and the need to provide transportation improvements to accommodate future growth. Still, this increase would be far less than the taxes paid in Europe and Japan on gasoline. In the long term, this TCM

---

assumes gas prices approaching levels in Europe and Japan, given the declining production of oil over time due to depletion of existing reserves.

- **Regional VMT Fees.** VMT fees would directly relate to wear and tear on the roads and the amount of running emissions generated by on road travel (but not cold start emissions). VMT would be less susceptible to revenue loss due future increases in fuel efficiency of cars and would have some impact on moderating the amount of vehicle travel conducted. A portion of the fee could be based on the air pollution characteristics of the vehicle (i.e., cleaner vehicles would pay less). These fees could eventually be considered as an alternative to raising the gas tax, and revenues could be used for a broad array of transportation and air quality programs. (Also see Vehicle Registration Fees below.)
- **Taxes on Diesel Fuel.** A higher diesel fuel tax would be used to reduce NOx and particulate matter emissions from older heavy duty diesel trucks, which can stay on the road for many years due to the durability of their engines. Funds could go to help offset the cost of purchasing new vehicles, repowering existing vehicles with cleaner engines, or retrofitting trucks with catalytic converters that significantly reduce NOx and particulate matter.
- **Emissions-based Vehicle Registration Fees.** Vehicle registration fees would be used to influence the purchase choices of new vehicles. Annual fees would be based on vehicle emission characteristics and the amount of annual driving that is conducted (which would be assessed at the time the vehicle undergoes a Smog Check). The fees would be used in turn to pay for various air quality programs, such as vehicle buy back, fixing emission controls on mid-aged vehicles, incentives to tune up vehicles prior to the next smog season, financial assistance to low income families that would face hardships with costly tune-ups, and other programs.

## Travel Market Affected

Market-based measures would affect all types of travel, including commuting, commercial trips, shopping, personal business, and social and recreational travel.

## Effectiveness

TCM 18 is expected to yield the following emission reductions:

	<u>ROG</u> TBD*	<u>NOx</u> TBD*
Congestion Pricing		
Gas Tax \$0.10/gal.		
HOT Network		
Regional VMT fee (\$0.05/mi)		
Gas Tax \$0.50/gal.		
VMT fees		
Diesel taxes		
Emissions-based fees		

\* Emission reductions would vary, depending on whether program is revenue neutral.

## Cost

---

Different fees would generate different amounts of revenue. Pricing measures would obviously entail out-of-pocket expenses for many drivers, in some cases substantial expenses, especially those who are either unable or unwilling to shift to alternatives to the single occupant vehicle. However, most of these expenses represent transfers within the region's economy that could be directed to enhanced transportation alternatives and vehicle emission reduction programs. Increased costs to households and businesses would be offset to a certain degree by reduced costs of vehicle ownership, operations and maintenance.

### **Impediments**

Bay Area business associations, government agencies and environmental organizations have historically expressed support for consideration of new pricing measures. Their support will be needed to secure legislation authorizing pricing measures. New fees would, however, have significant impact on business related costs and household expenditures, and therefore would continue to be unpopular with the public and Legislature. To obtain approval of new pricing strategies directed at improving air quality, there will need to be compelling reasons for their implementation based on tangible and near term improvements in traffic and air quality. Programs involving substantial pricing increases will need to mitigate the impacts on low income households.

### **Other Impacts**

Pricing strategies that reduce the number of vehicle trips by modest amounts in congested corridors could produce relatively large improvements in delay. Revenues from pricing strategies could also provide new transportation options that provide faster or more convenient travel and save users considerable amounts of time. Reduced travel demand could lead to considerable savings in fuel consumption, dependence on foreign oil, and greenhouse gas emissions. Reduced vehicle use could extend the useful life of vehicles, and may stimulate consumers into purchasing more fuel-efficient and lower polluting vehicles.

## **TCM 19 – IMPROVE PEDESTRIAN ACCESS AND FACILITIES**

### **Purpose**

Implementing measures to make pedestrian travel safer, more convenient and more attractive will promote walking, reduce the need to use autos, and therefore reduce mobile source emissions.

### **Background**

Virtually all travel, regardless of mode, entails some walking at some point in the trip. Many trips are very short in length. Approximately 14% of all trips are one-half mile or less in length, and 28% of all trips are one mile or less. These trip lengths are a reasonable walking distance for most people and represent an enormous opportunity to reduce motor vehicle use and emissions. Eliminating short vehicle trips is especially beneficial to air quality because vehicle emissions are highest at the beginning of a trip. In many parts of the Bay Area the share of trips made by walking is very small, as many people rely on the car. Much of this low level of pedestrian travel can be attributed to low density, single-use land use patterns and development of streets and roads and development projects that lack adequate attention to the pedestrian environment. MTC has recently focused more attention on pedestrian safety issues by creating a Regional Pedestrian Committee in 2002 to address the gamut of pedestrian planning and education issues of interest to local communities. Pedestrian improvements proposed in this TCM complement measures in other TCMs, particularly TCM 15 and TCM 20.

### **Description**

---

There are numerous actions that can be pursued in order to increase pedestrian travel, including the following:

- Local general plans, specific plans and zoning ordinances should promote land use patterns that facilitate walking, such as increased densities, mixed land uses, focusing development around transit stops, strengthening downtowns and community centers, infill development and reuse/redevelopment of underutilized land.
- The design and placement of buildings in new development should encourage walking, for example by providing sidewalks/paths, minimizing setbacks, locating entrances near sidewalks and transit stops, etc.
- Locate and design parking so that pedestrians have direct, attractive access.
- An integrated street network with direct routes for pedestrians and ensuring easy pedestrian access between neighboring developments, as well as downtowns, commercial areas and community centers, should be provided.
- Pedestrian amenities such as sidewalks, benches, landscaping, etc. should be provided at new development.
- Existing development and streets should be retrofitted to incorporate pedestrian-friendly improvements.
- Street design standards should enhance pedestrian safety and comfort through measures such as reduced street width, reduced turning radii, crosswalks with activated signals, curb extensions/bulbs, buffers between sidewalks and traffic lanes, street trees, etc. Traffic calming strategies are discussed in greater detail in TCM 20.
- 

Cities and counties can undertake a variety of actions to promote pedestrian travel, including the following:

- Review and revise general and specific plans to assure that land use policies promote development patterns that encourage walking and circulation policies that emphasize pedestrian travel.
- Review and revise zoning ordinances, subdivision ordinances, parking requirements and other local programs to include pedestrian-friendly design standards/guidelines.
- Review and revise street design standards to promote pedestrian access, safety and comfort.
- Include pedestrian improvements (e.g. sidewalks, lighted crosswalks, traffic medians and better signage) in local capital improvement programs.
- Designate a staff person to be pedestrian or non-motorized (pedestrian/bicycle) program manager.
- Require developers to provide pedestrian amenities in new projects.
- Identify and implement pedestrian-friendly improvements to existing streets and developments.
- Emphasize pedestrian safety in enforcement of local traffic codes and public education campaigns.

#### **Phase 1 (2004-2006)**

- The Air District, MTC and ABAG will comment on pedestrian improvements in related elements of city and county on general plans, policies and programs, and in CEQA documents (see TCM 15).
- MTC will continue to fund the Transportation for Livable Communities (TLC) program which includes funding for projects in local communities which improve pedestrian mobility.

- 
- MTC will continue to support the Pedestrian Safety Task Force, develop pedestrian safety programs, collect data on pedestrian safety issues, and report on safety trends in the annual State of the System Report.
  - The Air District's TFCA program funds certain pedestrian improvements (those that support development projects that reduce motor vehicle emissions).

### **Phase 2 (Beyond 2006)**

- MTC and the Air District will continue to identify and fund planning projects to identify ways to enhance pedestrian movement in neighborhoods, downtown centers, and near transit stops.
- Continue funding specific improvements through a variety of programs, including TLC, TDA Article 3, local sales tax measures, etc.
- Support Safe Routes to Schools (also see TCM 10)

### **Travel Market Affected**

Pedestrian improvements will tend to have a greater impact on trips for shopping, school, recreation and personal business since these trip types generally are shorter in length than work trips.

### **Effectiveness**

TCM 19 is expected to yield the following emission reduction:

<u>ROG</u>	<u>NOx</u>
TBD	TBD

### **Cost**

MTC's current TIP provides \$69 million for bike and pedestrian projects. Owing to the very localized nature of a large number of small projects, it is difficult to develop a comprehensive estimate of pedestrian funding needs.

### **Impediments**

Pedestrian improvements tend to have a lower priority in communities than improvements for autos and bicycles; therefore there is a need to raise the general awareness of the importance of pedestrian issues in communities and the need to integrate pedestrian improvements into street upgrade and maintenance projects.

Safety concerns related to crime as well as conflicts with motor vehicles sometimes dissuade people from walking. Pedestrian improvements and related programs, e.g., enforcement of traffic laws, should enhance pedestrians' actual and perceived safety.

### **Other Impacts**

In addition to reducing motor vehicle emissions, pedestrian improvements will decrease the chance of personal injury, benefit health and fitness, and generally foster a greater sense of community vitality.

---

## TCM 20 - PROMOTE TRAFFIC CALMING MEASURES

### Purpose

“Traffic calming” is the combination of mainly physical measures that slow vehicle traffic and improve conditions for pedestrians and bicyclists in residential and retail areas. These measures are often desired by communities that experience excessive cut through traffic or that want to slow vehicle speeds to protect pedestrians and cyclists. Children and older adults are often considered particularly vulnerable. Motor vehicle emissions are reduced to the extent that walking and cycling increase and overall vehicle travel in an area is reduced.

### Background

Traffic calming modifies the streetscape to reduce the number and speed of motor vehicles, smooth speeds and increase the attractiveness of transit, bicycling and walking. Traffic calming has been most extensively implemented in Western Europe. Traffic calming has grown fastest in Germany, with one province reporting over 8,000 traffic calming areas in 1989. Many of the traffic calming techniques used in Europe are implemented on an areawide basis, which is generally not the case in the US. Areawide traffic calming strategies are preferable because they improve pedestrian and cycling conditions throughout an entire neighborhood or district, rather than shifting traffic from one street to another.

Many communities in the Bay Area are developing traffic calming plans and installing traffic calming devices. Berkeley is developing a residential traffic calming program, and has installed numerous traffic diverters, speed humps, and other devices. Palo Alto has a Neighborhood Traffic Calming Program and has implemented traffic calming improvements in many parts of the city. Cotati completed a traffic calming plan for the downtown area. Oakland constructed a traffic median on International Blvd. in the Fruitvale district. San Francisco’s traffic calming program is implementing a variety of site specific and areawide projects.

### Description

There are many traffic calming strategies that cities and counties may consider. The most effective programs generally involve thorough consultations with residents and merchants, as well as public safety officials.

MTC’s Transportation for Livable Communities program and the Air District’s Transportation Fund for Clean Air fund traffic calming projects.

The following actions can be taken to implement traffic calming in the Bay Area:

- **Pedestrian Streets.** Pedestrian streets exclusively reserve streets for use by pedestrians. Consider converting streets to pedestrian streets where:
  - Streets have significant pedestrian activity, and
  - Pedestrians are able to access the area via transit, bicycle or walking and the area is difficult to access by motor vehicle.
- **Residential and Neighborhood Traffic Calming.** Implement traffic calming on residential and neighborhood streets through:
  - Road humps and speed tables which raise the surface of the road,
  - Traffic circles/mini-roundabouts that replace traffic signals and stop signs at intersections,
  - Narrowing of motor vehicle lanes, introduction of dedicated bike lanes and wider sidewalks,
  - Chicanes, which place physical obstacles or parking bays, staggered on alternate sides of the street so that motor vehicles must slow down to maneuver through the street,



- 
- Traffic throttles/pinch points that restrict a two-way road over a short distance to a single lane,
  - “No Entry” signage restricting through motor vehicle access,
  - Surface treatments including textured surfaces such as brickwork, paving and rumble strips designed to warn drivers of excessive speed or of an approaching hazard where speeds should be lowered, and
  - Merging the street/sidewalk to the same height and use of the same paving materials so that there is no distinction between the road and sidewalk.
- **Arterial and Major Route Traffic Calming.** Arterial traffic calming generally limits motor vehicle speeds to 33 mph on arterials and major routes, with the recognition that bicycle and pedestrian activity can still be enhanced. Implement traffic calming on arterials and major routes by:
    - Installing sidewalk bulbouts and traffic medians.
    - 
    - Replacing traffic signals and stop signs with modern roundabouts,
    - Improving pedestrian amenities and safety through making wider and attractive sidewalks, adequately marking crosswalks and installing count-down pedestrian signals. Strategies to facilitate pedestrian travel are discussed in greater detail in TCM 19.
    - Reduced speed limits and/or increased enforcement of speed limits and other traffic laws.

### **Travel Market Affected**

TCM 20 will affect the entire range of motor vehicle, transit, bicycle and pedestrian trips, including commute travel, school travel, shopping, personal business, recreation, and commercial travel.

### **Effectiveness**

Traffic calming techniques are most effective when implemented on an area-wide basis. TCM 20 is expected to yield the following emission reductions:

<u>ROG</u>	<u>NOx</u>
TBD	TBD

### **Cost**

The cost of traffic calming ranges from \$9 per square yard to \$18 per square yard of street/sidewalk. These costs are outweighed by the benefits of reduced traffic accidents and congestion. In 1990, traffic accidents alone cost the nation up to \$137 billion a year in direct costs, lost time and productivity. Traffic calming has the potential to reduce injury accidents by 50 percent. *[Need current safety data]*

### **Impediments**

If traffic calming is not implemented area wide but only in select and isolated streets, there is the potential for an increase in traffic in the surrounding areas due to trip diversion.

Police and fire protection agencies may have concerns with barriers and other devices that slow their response times. However, experience in many communities has shown that close coordination between transportation planners and public safety officials can resolve most of these

---

potential conflicts. Also, some studies have shown that when traffic calming leads to fewer traffic accidents, there are fewer emergencies needing a response.

Cities and counties can include area-wide traffic calming policies in general or specific plans, or develop traffic calming plans, to ensure effective traffic calming measures in the overall area and minimize potential adverse affects.

### **Other Impacts**

Traffic calming results in fewer vehicle and pedestrian accidents and injuries in areas where it is implemented. Lower traffic volumes on residential streets results in lower community noise levels. Traffic reductions on some streets may lead to more traffic on other streets without any traffic calming measures as diverted vehicles use alternative routes. Traffic calming can contribute to more livable neighborhoods and vibrant shopping areas.